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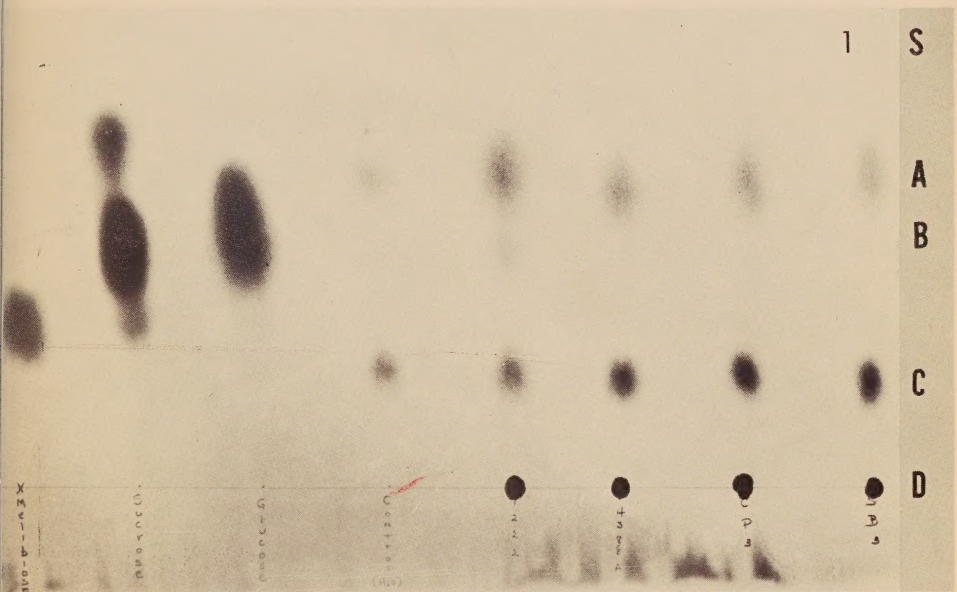
The JOURNAL of the BALTIMORE COLLEGE OF DENTAL SURGERY



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Harold Hillenbrand, D.D.S.

University of Maryland Honors' Convocation

June 6, 1969
Baltimore, Maryland

A little more than four years ago—when this present senior class was still in the throes of completing its predental studies—I had the honor of addressing the faculty and students of this institution on the occasion of its 125th anniversary. This, the world's oldest dental school, has often served as the leader and innovator in dentistry and I am sure you here today at this Honors' Convocation who have successfully completed your dental training will take much of this heritage and tradition with you as you enter the larger and more difficult world outside these halls.

I am sure that I would not be permitted to continue to carry my membership card in the convocation speakers' union, were I not to chant the words which identify some of our most serious national concerns and provide an instant background for dozens of commencement addresses: Viet Nam, campus revolt, acid and speed, miniskirt or no skirt at all, hair, hunger, dissent. Each of these words is powerfully evocative of mod-colored images of some phase of our present-day society.

These images admittedly are different from the ones which would be conjured up by a similar, serial listing in the time when I first sat in a commencement audience. In that ancient day our targets and heroes were: the architects of the Great Depression; Henry Mencken and the *American Mercury;* the Prohibitionists who put our wine in coffee

cups and our gin in the bathtub; Hemingway who began to write publicly about sex as if it really existed and was practiced fairly frequently even by the common people; Calvin Coolidge for his taciturnity which properly concealed a fine, medieval mind. And so it went in that ancient day: protest, graduation, work, earning a living, raising a family, increasing affluence, educating the children and refocusing our revolt and dissent through the sharper prisms of experience and maturity. You will do the same and shouldn't be scolded for doing so in your own way. Today, the techniques of dissent and revolt are different than they were in my time.

There are many changes of some magnitude but you, the men and women who participate, are much the same as in my day except that you are conditioned by a better standard of living and affluence, more knowledge and better education. However, when you young graduates take the principles of this generation and apply them to new situations and new concepts, you will have available to you the knowledge and discipline and results of your dissent learned in this university. But caution has recently been expressed by the president of one of our universities and he has words for you which I would now like to echo:

> *My caution is that you do not permit rebellion to be the chief architect of your way of life and of your standards of behavior. Of course it is natural that you should consider yourselves more responsible and more prepared to exercise freedom than your parents believe you to be, but beware of the easy trap into which you can fall of determining all of your attitudes on the basis of rebellion to constituted authority or the older generation . . . Living only a life of protest makes no more personal sense than taking in each other's laundry makes economic sense. Protest, yes, injustice and indignity but you will find only futilty in protesting the fact that there are people older than you are. . . .*

If your "day of change" is illumined by these principles, this university offers you, if nothing more, a safe and lighted passage for your participation in the work of a world in crisis. It is by such participation in the world's work that we discharge the obligation incurred as beneficiaries of the education you have received.

An honors' convocation rightfully marks a beginning, and I want to give you an idea of the profession and life you face as you leave the academic world.

I want to discuss good revolution and change and challenge within the dental profession and its educational institutions; revolution and change within the practice of dentistry. This revolutionary process is enabling the dental practitioner to provide more and better care to the millions of people who are now demanding health as an essential right of the American way of life.

John W. Gardner, the former secretary of the Department of Health, Education and Welfare, has pointed out the inevitability of change in our society and of the need for well-educated men and women to assist in making this change palatable and in the best interests of everyone. He says:

> *Many Americans have a sentimental and undiscriminating view of change. They think it is, without qualification, a good thing. But death is a form of change. So is deterioration. A society must court the kinds of change that will enrich and strengthen it, rather than the kinds that will fragment and destroy it. . . .*

What are some of the items of change that are affecting our profession?

—Item: this country and the dental profession has, or can get, the enterprise and the resources to provide dental health care as a matter of right, and not as a privilege, for all citizens.

—Item: the federal government is already spending $200 million for dental services outside of the armed services and the Veterans Administration.

—Item: the dental profession in this country is producing $3.7 billion dollars worth of dental care annually and, under programs already on the drawing boards, must produce an additional one billion dollars worth of care in the next five years without an appreciable increase in the work force of professional dentists.

—Item: the American Dental Association has recommended the design of a program which will eventually mediate dental care for all pre-school and school children. This program will begin on a modest basis and will eventually reach national proportions. It is hoped —Congress willing—to launch experimental pilot programs to initiate the children's program within the next year.

I could cite many more items of immediate concern but I think the trend is unmistakable—the dental profession is being challenged to produce a high quality of dental care in an amount never before dreamed of even in this, the richest country of the world.

To meet this challenge will require all of the imagination, innovation, resources and effort that the dental profession can muster and you must do your share. There are many opportunities for participation for all who have been trained in the disciplines of work beyond the dental profession as university graduates.

There is the need to use the results of industrial production in providing better schools, better homes and better roads. There is a need to make collective bargaining work and to insure that the results of our national productivity lead to more leisure and a higher culture for our people.

In the field of total health, there is an especial opportunity for the graduates of Maryland University. Here there is need to close the gap between our knowledge of the health sciences and their application to more of the people; to reconcile the universal need for health aids with rising costs and increasing technology so that health care may be available to all; to learn more about the complex problems of mental health, increasingly jeopardized when persons and countries are involved in perennial crisis; to preserve, in spite of social and technical developments, the relation of practitioner and patient so that there may be a full understanding of the personalities involved in human disease and in human suffering.

In the field of the arts, there is need to adapt our art forms to the aspirations and ideals of our modern life; to overpaint the stains and scrawls which so frequently today vandalize our dignity and our culture.

In the field of psychology, there is need to know more about the forces involved in aggressiveness, hostility and destruction; of the forces involved in the collective hatreds and tensions which govern groups, races and nations.

In the field of sociology, there is need for better programs for diminishing the misery still existing in so many of our cities and countries. The slums, the inhuman congestion, the insecurity of children, the aged and the infirm all cry for attention and relief.

In every human activity, then, there is need for those with education and imagination and courage to take a personal part in the world's crisis. This role—its magnitude and its effectiveness—will be determined in major part by the education you have received from Maryland University. Such participation is the only way in which you can make your personal —and your generation's—transition from this day of change to a time of new vision. Such participation is the destined pilgrimage of my, your and every generation until the universe again becomes a mass of whirling gases and energy hurling itself mindlessly into new infinity of darkness and cold.

I know all of you will have your role in such a world as dentists, university graduates, health profession leaders, and citizens of a new world.

Dimensional Stability of Two Thermoplastic Denture Base Materials*

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For denture wearing patients retention, comfort, masticating efficiency and the preservation of oral health are dependently related to the dimensional stability of denture base materials. Dimensional stability is affected by curing shrinkage and water sorption, and, therefore these essential factors should be considered in the evaluation of any denture base material. The two thermoplastic denture base materials, Biojekt and Pol 3‡ imported from West Germany are being advertised to the dental profession in the United States of America. Manufacturers claim that Biojekt has no curing shrinkage and no water sorption while Pol 3 has very low water sorption. The purpose of this investigation was to evaluate the curing shrinkage and the dimensional changes due to water sorption of Biojekt and Pol 3 (Fig. 1). Biojekt is a co-polymer with high acrylnitril content while Pol 3 is a hard polyamid.

*This investigation was supported in part by Public Health Service Research Grant DE-01826-01 from National Institute of Health.

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‡B. L. Dental Company, Inc., Richmond Hill 18, New Jersey.

MATERIALS AND METHODS

Forty-four trial denture bases were made according to the following procedure. Two thicknesses of base plate wax were adapted to a maxillary metal cast for the denture base. The waxed-up cast was invested in a special injection type flask with sprue holes. The sprue holes were waxed-up. After boiling out the wax the flask was ready for casting. The flask was closed and placed in an oven for about 30 minutes at 60 degrees centigrade to secure uniform temperature in the flask. In the meantime the plastic material was placed in the Protomat (Fig. 2). The temperature was adjusted according to the manufacturer's instructions (185 degrees C. and 190 degrees C. for Pol 3 and Biojekt respectively). The plastic material was injected in the flask under 60 pounds of pressure. The trial denture bases were bench cooled, deflasked and the sprues were removed.

GROUP ONE

Twelve trial denture bases designated as Group I, were made in each of the two materials in order to evaluate dimensional changes and water sorption. Three depressions were drilled in the denture bases of Group I by means of a No. 2 round steel bur, one hole in each of the tuberosities and one in the incisal papilla region. These depressions were used to re-orientate the denture bases to the same position each time they were mounted on the Contour Meter[1,2]. Each denture base was identified by a Roman numeral. The denture bases were weighed within one hour after removal from the

cast. Contour Meter readings were recorded antero-posteriorly in the midsuture line region and from flange to flange in the tuberosity region. The denture bases were kept in water at room temperature. After a specified period each denture base was taken out of the water and dried. The denture bases were then weighed again and contour data were recorded from the previously mentioned regions. Water sorption and dimensional changes were evaluated on the basis of the gain in weight and by changes of contour data.

GROUP TWO

Curing shrinkage was determined from twelve denture bases made in each material. In Group II, a depression was drilled by means of a No. 2 round steel bur at the left and the right tuberosity regions of the metal cast. A drill press was used in order to drill the depressions to approximately the same depth. This also provided the two depressions to be in the same plane, which made possible the recording of the linear measurements accurately on the Contour Meter. The linear measurements were made on the cast between the deepest center points of the depressions along an axis perpendicular to the plane of the dental ridge. It was found that the stylus of the Contour Meter could be located correctly at the deepest center point of a depression or the corresponding highest center point of the half sphere at different trials. The Contour Meter gave the readings in 1/100 of a millimeter. Denture bases of Group II were fabricated on the cast by the same procedure as outlined for the Group I. Linear measurements were made within one hour of the removal of the dentures from the cast. Measurements from the highest center point of one half sphere (made by the depression in the cast) to another half sphere were made by means of the Contour Meter. These values were compared with the measurements made earlier on the metal cast. Curing shrinkage was thereby evaluated by the decrease in the linear measurement of two fixed points from the metal cast to the denture base.[3]

OBSERVATIONS AND RESULTS

The mean linear measurement on the metal cast was found to be 45.31 millimeters (Table I). The Biojekt denture base showed a mean linear value of 45.25 millimeters which was 0.06 millimeter less than the value on the metal cast. The curing shrinkage was evaluated to be 0.13 percent for the Biojekt material (Table I). In the case of Pol 3 the linear measurement was found to be 45.0 millimeters or 0.24 millimeter less than the value on the metal cast (Table I). Hence 0.53 percent of curing shrinkage occurred in the Pol 3 denture bases.

Mean gain in weight of the denture bases when kept in water from 3 days to 12 months is illustrated in Table II. Biojekt denture bases showed a mean gain in weight, due to water sorption, of 0.62 percent after 3 days. The gain in weight increased to 1.35 percent after 12 months (Table II). Pol 3 had a mean gain in weight of 0.28 percent after 3 days in water and 1.69 percent after 12 months (Table II).

It has been calculated that for every loss or gain of 1 percent by weight of water by a denture base

there is dimensional change linearly of the order of 0.2 percent.[3] Accordingly, the linear dimensional changes were calculated and are shown in Table II. A linear dimensional change of 0.27 percent and 0.34 percent occurred in Biojekt and Pol 3 respectively after 12 months immersion in water (Table II).

Table III shows the values of the curing shrinkage and the linear dimensional change due to water sorption in both denture base materials.

DISCUSSION

Linear measurements were made in the region of the maxillary tuberosity in this study, because it has been demonstrated[3] that the linear changes occurring across the posterior portion of a denture are of a significantly greater magnitude than in any other area. The method of computing curing shrinkage from the linear change has been used by other investigators [4 5 6 7 8]. The curing shrinkage of Biojekt is compensated, almost completely, by water sorption after 3 days storage in water (Table II). The increase in dimension due to water sorption, however, increased to 0.25 percent in two months, almost twice that of the curing shrinkage. The increase of 0.02 percent due to water sorption from 2 months to 12 months is insignificant.

Pol 3 showed 0.53 percent of curing shrinkage which is much higher than the Biojekt material but it is comparable to some of the curing shrinkages of other plastic materials [4 5 6 7 8]. Dimensional change due to water sorption after 12 months was 0.34 percent which partly compensated for the curing shrinkage (Table III).

The contour readings of denture bases before and after immersion in water were plotted on graph paper.[2] It was found that the changes in the contours of the trial denture bases were minor, both antero-posteriorly in the mid-suture line region and flange to flange in the maxillary tuberosity region. The changes in the contours of the denture bases due to water sorption appeared to compensate for the curing shrinkage.

CONCLUSIONS

1. The curing shrinkage of Biojekt was 0.13 percent which was over compensated by the dimensional change due to water sorption.

2. The curing shrinkage of Pol 3 was 0.53 percent which was partly compensated by the dimensional change due to water sorption.

3. Biojekt and Pol 3 are as dimensionally stable as conventional denture base materials. A clinical study is necessary to confirm these results obtained by using the technic denture bases.

TABLE 1 MEAN LINEAR MEASUREMENTS AND CURING SHRINKAGE

Material	*Linear Measurements on the Cast*	*Mean Linear Measurements on the Denture Base*	*Curing Shrinkage*
Biojekt	45.31 mm.	45.25 mm.	0.13%
Pol 3	45.31 mm.	45.07 mm.	0.53%

TABLE II MEAN DIMENSIONAL CHANGES DUE TO WATER SORPTION

Material	*Mean Gain in Weight in Percent (%)*				*Dimensional Change Linearly in Percent (%)*			
	3 Days	7 Days	2 Months	12 Months	3 Days	7 Days	2 Months	12 Months
Biojekt	0.62	0.88	1.28	1.35	0.12	0.17	0.25	0.27
Pol 3	0.28	0.56	1.23	1.69	0.05	0.11	0.25	0.34

TABLE III MEAN LINEAR CURING SHRINKAGE AND DIMENSIONAL CHANGE

Material	*Curing Shrinkage*	*Dimensional Change After 12 months in Water*
Biojekt	0.13%	0.27%
Pol 3	0.53%	0.34%

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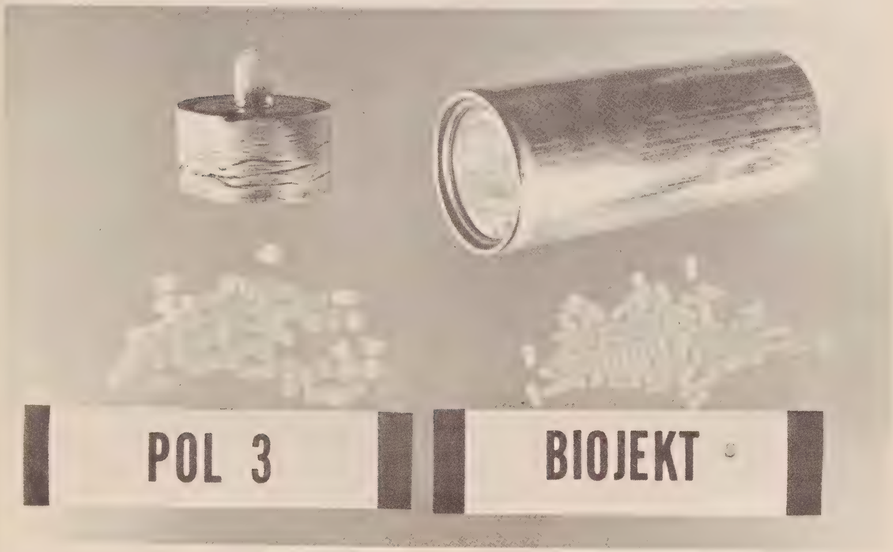

FIG. 1. Granules of Pol 3 and Biojekt are shown on the left and right respectively.

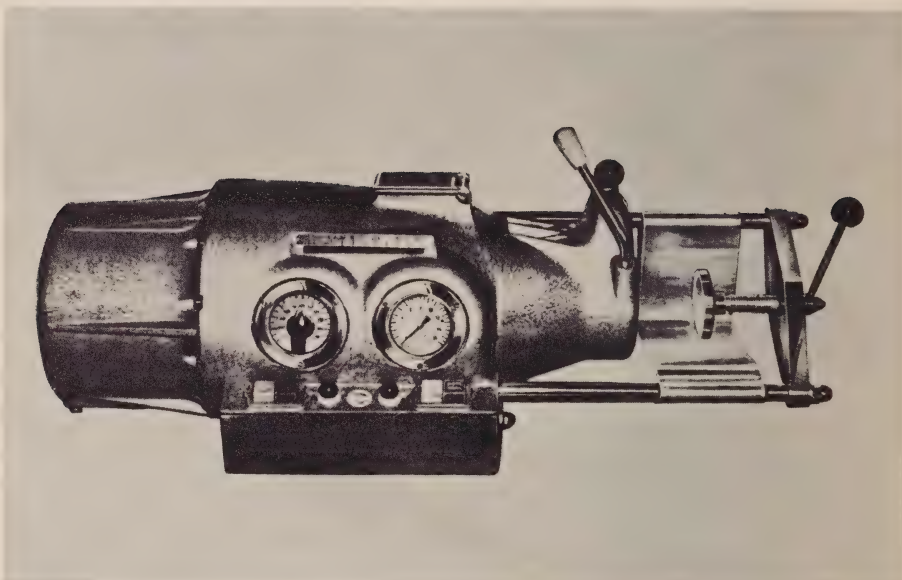

FIG. 2. The Protomat is a device used for heating and injecting thermoplastic materials. The thermoplastic materials are heated electrically and injected into the flask by compressed air.

Experimental Renal Disease Induced By Streptococci Utilizing An Intraperitoneal Diffusion Chamber

by

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SUMMARY

Female Spraque-Dawley rats exposed to intraperitoneal diffusion chambers containing viable hemolytic streptococci of group A were used to induce experimental glomerulonephritis. Experimentation with diffusion chambers, the streptococcal exposure mechanism, provided the development of a plexiglass chamber which was useful due to its lack of leakage, larger inoculation volume, and diminished foreign body action. Urine samples of the experimental animals (started 4 days after implantation of the chamber) showed significant proteinuria during the first sampling period (4-6 days post insertion) and showed a moderate proteinuria throughout the rest of the 30 day experimental period. Histologic evidence of glomerular disease was the most severe after the first 4-6 days following insertion. At this time both tubular and glomerular damage was observed in focal cortical areas. This damage consisted of glomerular hypercellularity and diminished space of Bowman, cloudy swelling and lack of tubular architecture primarily in the proximal convoluted tubules, although in the most severe areas of damage the distal tubules were also affected. Although the genesis of the characteristics of this disease could not be ascertained due to the limits of this study, similarities of this experimental disease to post streptococcal glomerulonephritis may provide a useful model for studying the pathogenesis of the latter.

INTRODUCTION

The use of intraperitoneal diffusion chambers, as the group A streptococcal exposure mechanism, has been utilized in many experimental animal counterparts to human glomerulonephritis (Kelly and Winn, 1958; Markowitz, Armstrong and Kushner, 1960; Hinkle, Partin and West, 1960; Tan, Hackel and Kaplan, 1961; Tan and Kaplan, 1962; Eisen, Eidinger, Rose and Richter, 1964; Lindberg, Vosti and Raffel, 1967; Holm, Jonsson and Zettergren, 1967). The results of these investigations have been varied and the need for further experimentation prevails. Two of the most frequent characteristics of renal disease sought and noted were histopathological evidence and proteinuria.

The present study does not isolate the metabolic or degradation products of the streptococci which may cause the experimental disease, but describes an experimental model which produces proteinuria

and histopathological variations in the experimental animals and compares these characteristics of glomerulonephritis to those produced in the previous investigations.

MATERIALS AND METHODS

Animals and Operational Technique

Female Sprague-Dawley rats weighing 100-150 grams were used. They were fed Purina Laboratory Chow without antibiotics. Animals, based on the bacterial strain utilized, were divided into four groups: Group A included 18 animals subjected to strain 11434; Group B included 12 animals subjected to strain 20969; Group C included 9 animals subjected to strain 21355 and Group D included 12 control animals. The animals were initially anesthesized with ether in a bell jar and then an inhalation mask was positioned over the animal's head. The animal was then placed on a teflon lined operating table, the table and the surrounding area previously washed with Roccal solution. After induction 4 to 5 drops of ether was dropped onto the mask every 5 minutes. The abdominal region of the animal was shaven, washed with iodine tincture, and covered with sterile drapes. The operating instruments were sterilized by autoclaving at 15 lb. pressure (121°C) for 15 minutes.

A midline abdominal incision was made and the diffusion chamber placed into the peritoneal cavity by means of sterile forceps. The muscle layer was continuously sutured with silk thread followed by a closing of the epidermal layer with individual silk sutures. The sutured epidermal layer was swabbed with iodine tincture and the inhalation mask removed.

Bacteria

Three strains of group A beta hemolytic streptococci were used (11434, 20969, and 21355). Strain 11434 was a type 12 strain taken from a patient with acute glomerulonephritis (American Type Culture Collection). These strains were stock cultured on cystine trypticase agar (B.B.L.* — No. 11094) and subcultured during experimental periods on blood agar. An inoculate from the blood agar plate was placed into 10 ml. of brain heart infusion broth (B.B.L. — No. 11059) and incubated at 37°C for 18 hours. The experimental animals received 0.5 ml. of an 18 hour brain heart infusion broth culture while control animals had 0.5 ml. of sterile brain heart infusion broth in their chambers.

The streptococci were grouped by means of group A antisera (B.B.L. — No. 40687) using the autoclave method for antigen preparation (Lancefield, 1928, 1938; Rantz and Randall, 1955). Grouping was also done by inhibition of growth on blood agar with group A bacitracin discs (Taxos A, B. B. L. — No. 31040), (Kramer and Goldstein, 1966; Maxted, 1953; Pelowitz, 1964).

Diffusion Chamber

A modified plexiglass chamber was developed. The main compartment is a 13 mm. length of plexiglass tubing with an external and internal diameter of 15 mm. and 7 mm., respectively. To this chamber was sealed a 0.45 micron poracity Millipore membrane (M.F.C.*

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*Baltimore Bacteriological Laboratory, Inc. A Division of Becton, Dickinson and Company, Baltimore, Maryland.

*Millipore Filter Corporation, Bedford, Massachusetts.

— No. TWPO1400) by using plexiglass chips dissolved in chloroform as the cement. This chamber was sterilized by means of ethylene oxide. The bacteria were introduced through an inoculation pore in the wall of the plexiglass tubing and the inoculation pore closed by means of a plexiglass plug inserted into the pore and then sealed using the same cement.

The chamber was permitted to remain in the animal for various time periods up to 30 days. At the end of a predetermined period the chamber was removed from the animal and the outside surfaces streaked on a blood agar plate to check for bacterial leakage. The contents of the chamber were aspirated and again streaked on a blood agar plate. The plates were then incubated at 37°C for 36 hours and checked for beta hemolytic colonies during this time interval. If any beta hemolytic streptococci like colonies were present, they were grown in brain heart infusion broth and gram stained, cultured on mannitol salt agar, and finally grown on bile blood agar.

Urine Specimen Collection and Examination

A metabolism cage designed to collect urine without fecal contamination was used (Will Scientific* — No. 2300). During the 18 hour collection period the animals were given water ad libitum but deprived of food during this interval. The initial urine samples were collected 4 days after introduction of the chamber and continued for 30 days. The total length of urine sample collection was arbitrarily divided into 4 sampling periods as follows: 4-6 days post insertion, 7-13 days post insertion, 14-20 days post insertion, and 21-30 days post insertion. The urinary protein was measured by the Shevky and Stafford method (1923) which utilized Tsuchiya's reagent for precipitating the protein. Microscopic examinations were made of the urine sediment for erythrocytes, renal tubular epithelial cells, and urinary casts.

Histological Observations of the Kidneys

At various intervals corresponding to the urine sampling periods, animals were sacrificed by decapitation and the kidneys placed in neutral buffered formalin and Millonig's fixative (Pease 1964). Paraffin sections were stained using hematoxylin and eosin and by the periodic acid Schiff method of Lillie (1947).

RESULTS

Urinary Results

The proteinuria seen in the control (Group D) animals never exceeded 4.2 mg./100 ml./18 hr. Group A (11434), Group B (20969), and Group C (21355) animals displayed a level of proteinuria higher in all sampling periods than the control animals. The highest level of proteinuria was seen in all experimental groups in sampling period I (4-6 days post insertion). In this first sampling period 78%, 100%, and 66.6% of the animals in Groups A, B, and C respectively displayed a proteinuria greater than 7.0 mg./100 ml./18 hr. which is the average proteinuria seen in the experimental groups in the last two sampling periods. As the exposure time lengthened the level of proteinuria dropped in all three experimental groups. In the second

*Will Scientific, Baltimore, Maryland.

Figure 1

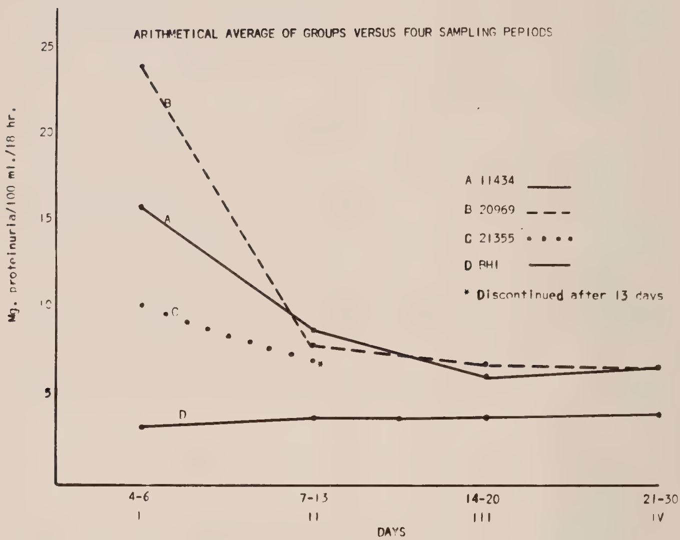
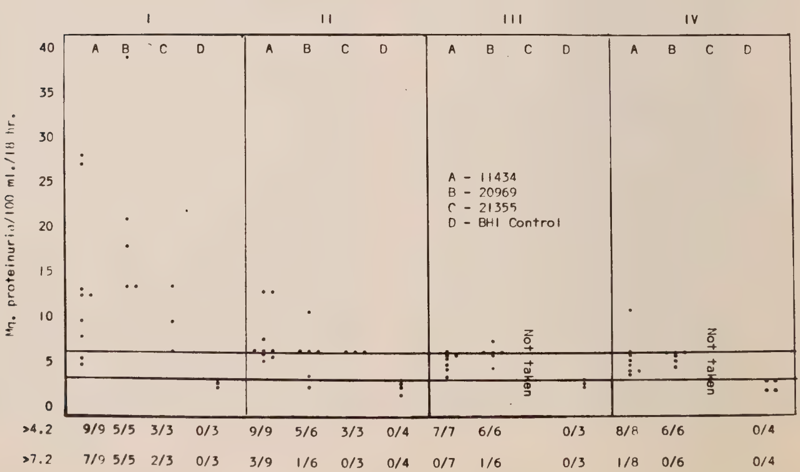


Figure 2

DISTRIBUTION OF GROUP MEMBERS DURING EACH SAMPLING PERIOD



sampling period (7-13 days post insertion) 33.3%, 16.8%, and 0% of the animals in groups A, B, and C respectively attained a level higher than 7.0 mg./100 ml./18 hr. During the second period all but one of the animals from Groups A, B, and C displayed a higher proteinuria than that of the control animals. The last two sampling periods displayed the Groups A, B, and C a still higher proteinuria than Group D, but the margin of difference decreased as the sampling periods continued. At the last sampling period Groups A and B were still 2 mg./100 ml./18 hr. higher than Group D animals (Figures 1, 2).

Microscopic examination of the urine sediment displayed that erythrocytes, renal tublar epithelial cells, and hyaline casts were more prevalent in the experimental animals than in the control animals.

Histopathological Results

At autopsy, the membranes of the chambers of experimental animals were usually covered by dense collagenous adhesions. The kidneys appeared normal upon visual inspection with regard to size, color, or gross lesions. The animal kidneys were fixed, embedded in paraffin, and sectioned according to routine histological procedures. Sections were stained with hematoxylin and eosin and periodic acid Schiff stains. The following microscopic observations were made with comparable control sections. In focal cortical areas there were renal corpuscles displaying hypercellular glomeruli accompanied with a reduction of Bowman's space. Definite proximal tubular involvement was seen as a disarray of normal histological architecture and, in many cases, the tubular cells displayed a cloudy swelling and the nuclei varied from a marked eosinophilia to an unstained condition (Figures 3, 4, 5, 6). The lumens of the proximal tubules contained eosinophilic and periodic acid positive casts (Figures 7, 8, 9, 10).

Animals displayed the most severe damage to the kidneys in the first sampling period. As the exposure period lengthened (sampling periods II, III, IV) the amount of apparent damage decreased, but after 30 days the glomerular and tubular involvement could still be ascertained.

DISCUSSION

The results of diffusion chamber experiments measuring as characteristics proteinuria and histologic variation are summarized in Table I. Comparisons of these results are difficult because of the variation in (1) animal species and strain utilized (mouse, rabbit, and rat), (2) the type of bacteria used (different types of Group A and non-A groups), (3) means of assessing disease (proteinuria and histological techniques), and (4) duration of the chamber implantation (4-60 days).

In this study localized involvement of both the tubules and the glomeruli were seen. These characteristics were noted in Kelly and Winn's (1958) investigation and only those chambers containing 12N streptococci produced this condition. However, it was not mentioned whether this damage was focal or diffuse and no proteinuria measurements were presented so further comparison with this study is difficult. The other studies using diffusion chambers noted only heavy tubular involve-

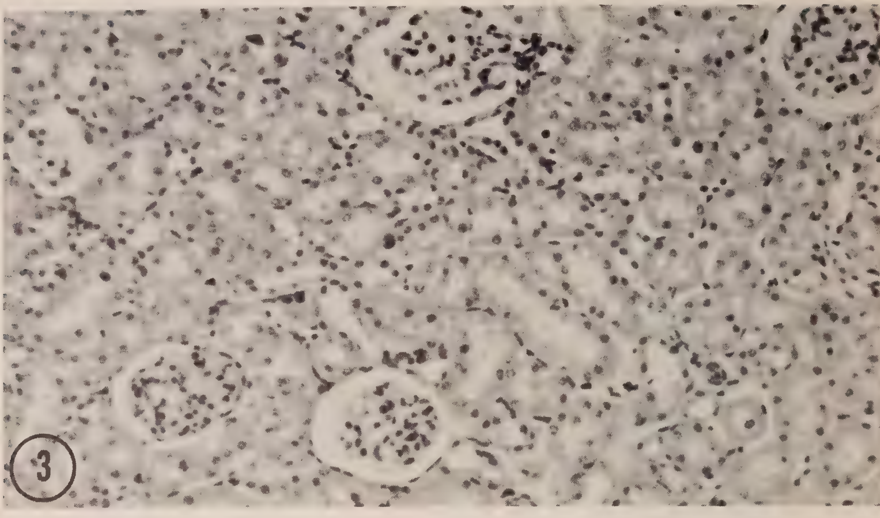


FIG. 3. Photomicrograph of a control animal sacrificed 5 days after implantation of a chamber containing sterile brain heart infusion broth. Normal glomeruli and tubules are seen.

H & E, approximately 250x

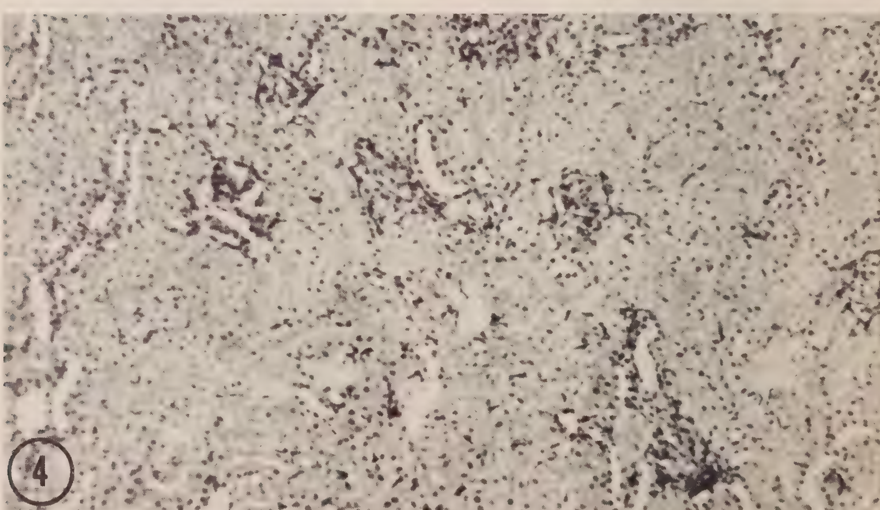


FIG. 4. Photomicrograph of a rat kidney sacrificed 5 days after implantation of a chamber containing Group A, type 12 streptococci. Hypercellular glomeruli, reduced Bowman's spaces, and lack of normal architecture are evident.

H & E, approximately 250x

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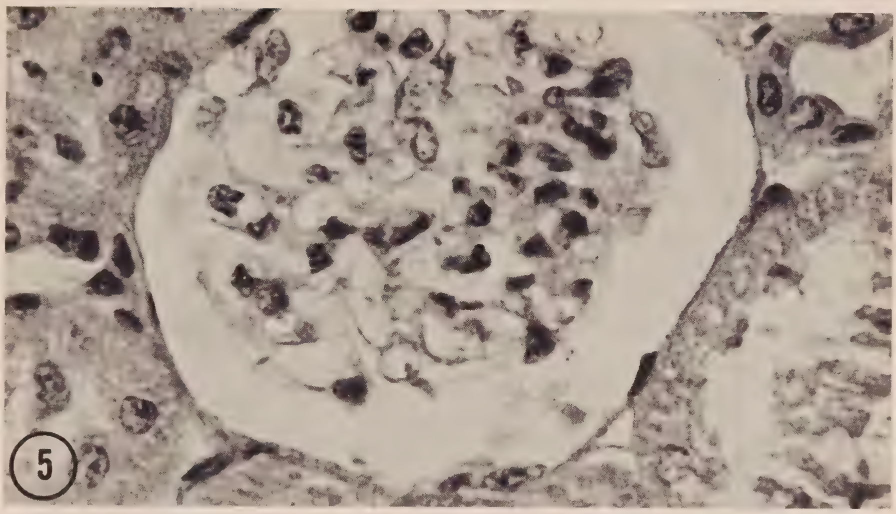

FIG. 5. Glomerulus of a control animal showing thin walled patent capillaries.
H & E, approximately 2000x

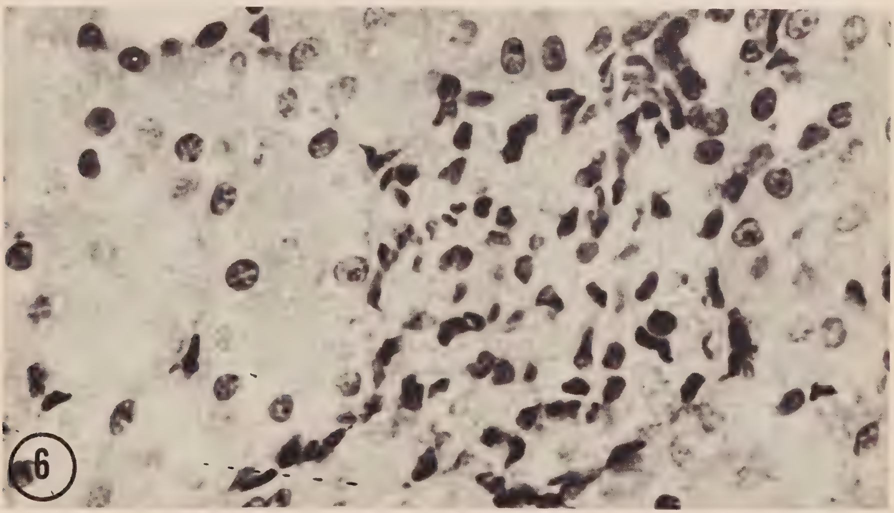

FIG. 6. Glomerulus of experimental rat sacrificed 5 days after initial exposure to Group A, type 12 streptococci. Hypercellularity and a reduced Bowman's Space prevails. Cloudy swelling of the proximal convoluted tubular cells is seen.
H & E, approximately 2000x

Cortical Region of the Kidney Stained Utilizing the Periodic Acid Schiff Technique.

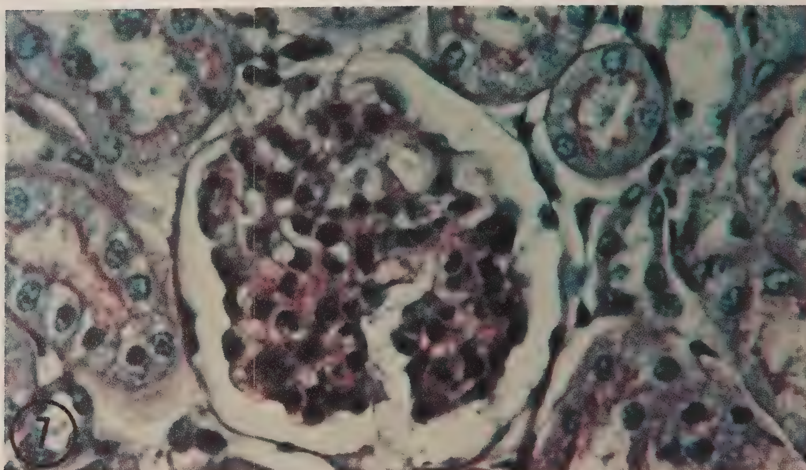

FIG. 7. Control animal displaying a normal glomerulus and basement membranes.

PAS, approximately 320x.

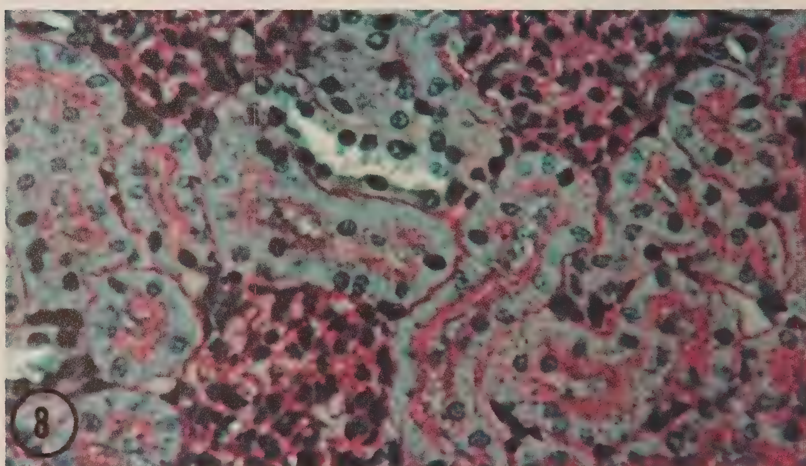

FIG. 8. Experimental animal showing congested glomeruli, moderate thickening of the basement membranes, and PAS positive material in the lumens of the proximal convoluted tubules.

PAS, approximately 320x.

Cortico-Medullary Region of Kidney Stained Utilizing the Periodic Acid Schiff Technique.

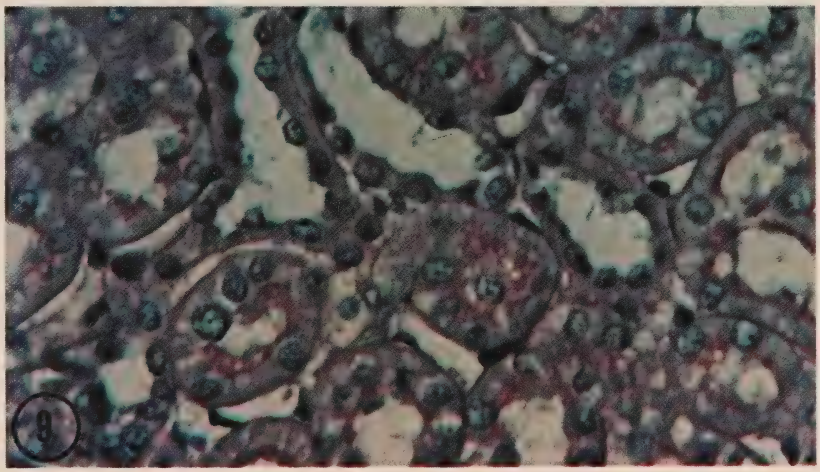

FIG. 9. Renal tubules of control animal displaying normal architecture.
PAS, approximately 320x.

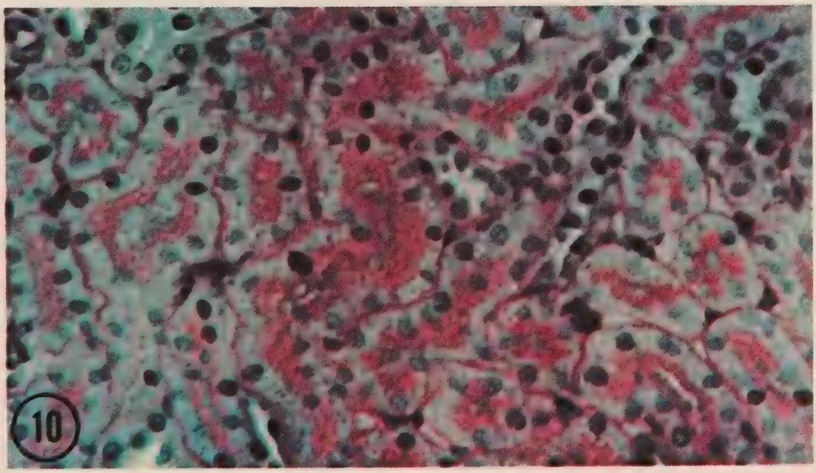

FIG. 10. Experimental animal showing moderate thickening of the basement membranes and PAS positive casts in the lumens of the tubules.
PAS, approximately 320x.

TABLE I

SUMMARY OF DIFFUSION CHAMBER EXPERIMENTS MEASURING PROTEINURIA AND HISTOLOGIC VARIATION *

REFERENCE	ANIMAL	STREPTOCOCCI GROUP	STREPTOCOCCI TYPE	PROTEINURIA	HISTOLOGIC LESIONS TUBULAR	HISTOLOGIC LESIONS GLOMERULAR
a. Kelly and Winn (1958)	Mouse	A	12N	Not Reported	Moderate	Moderate
		A	12		0	0
		A	3		0	0
		A	36		0	0
b. Hinkle et al (1960)	Mouse	A	12N	Moderate	Moderate	Minimal
		A	12	Moderate	Moderate	Minimal
		A	3	Minimal	?	0
		A	6	Minimal	0	0
		A	36	Minimal	0	0
		D		Minimal	0	0
c. Markowitz et al (1960)	Rat	A	12N	Moderate	Minimal	Mild
d. Tan et al (1961)	Mouse	A	12N	Moderate	Moderate	0
		A	12	Moderate	Moderate	0
		A	4	Moderate	Moderate	0
		C		0	0	0
		D		0	0	0
		G		0	0	0
e. Eisen et al (1964)	Rat	A	12N	Not Reported	Moderate	?
	Rabbit	A	12N	0	Moderate	?
f. Lindberg et al (1967)	Rat	A	12	Moderate	0	0
		A	6	0	0	0
		A	1	0	0	0
		C		Moderate	0	0
		G		0	0	0
g. This Study	Rat	A	12N	Moderate	Moderate	Moderate
		A		Moderate	Moderate	Moderate
		A		Moderate	Moderate	Moderate

a. Chambers removed after 24,48,and 72 hours. Animals sacrificed 7 days later.
b. Chambers removed after 48 hours. Animals sacrificed 2 to 7 days later.
c. Chambers removed after 72 hours. Animals sacrificed 1,2,and 3 weeks later. Virulence of culture enhanced via mouse passage.
d. Chambers removed after 48 hours. Animals sacrificed 1 to 7 days later.
e. Chambers removed at time animals were sacrificed,2,7,21,28,and 42 days after insertion.
f. Chambers removed after 60 days at time of sacrifice.
g. Chambers removed at various intervals during 30 day period. Histologic damage seen only in focal cortical areas.

* Modified Table from Lindberg, Vosti, and Raffel (1967).

ments and usually associated a toxic factor produced by the streptococci as causing these changes (Hinkle, Partin, and West, 1960; Tan, Hackel, and Kaplan, 1961; Eisen *et al.*, 1964). After Markowitz, Armstrong, and Kushner (1960) enhanced the virulence of the streptococcal strains utilized in their study, they reported mild spotty glomerular changes accompanied by eosinophilic casts both in proximal and distal convoluted tubules. They stated that no satisfactory conclusion could be reached as to the genesis of these renal lesions. It is possible that the chamber they used (Kelly and Winn's modification, 1958) contained a smaller volume of inoculant as compared to the one employed in this study. Therefore the virulence of their bacterial strain would need to be enhanced in order to obtain the same effect as a larger volume of less virulent bacteria. Lindberg, Vosti, and Raffel (1967) found a significant higher proteinuria was produced when group A, type 12N and group C streptococci were placed in the chamber. In most instances proteinuria was correlated with the presence of bound gamma globulin and M protein in the region of the basement membrane of renal glomeruli. It is disappointing that they found no histologic changes in the morphology of glomeruli, after 60 days, during which period a significant proteinuria was observed.

Two animals, which were directly injected with 0.5 ml. of group A, type 12N, did not show any proteinuria throughout the first sampling period (4-6 days post injection). The same strain and the same inoculation volume when placed in the diffusion chamber did produce proteinuria by the first sampling period. This difference was thought to be due to the bacteria being confined inside the diffusion chamber and not being destroyed by the animal's body defenses.

Because of the increased proteinuria and the histopathological variations observed in the experimental animals, as compared to the controls, these two characteristics were selected criteria of induced renal disease following streptococcal infection.

ACKNOWLEDGEMENT

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A PRELIMINARY STUDY OF THE INCORPORATION OF GLUCOSE-C^{14} IN THE ENZYMATIC SYNTHESIS OF SUCROSE AND LEVAN BY THE LEVANSUCRASE SYSTEM OF *Streptococcus salivarius*

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SUMMARY:—It has been reported by many investigators that the reactions catalyzed by the levansucrase system of very diverse organisms follows a similar pattern. The purpose of this study was to determine if the *Streptococcus salivarius* levansucrase system conformed to this pattern. Cell free extracts of the enzyme were incubated with raffinose and glucose. If the hypothesis is valid, sucrose and levan should be synthesized by fructosyl transfer from the raffinose to the glucose. C^{14} labelled glucose was introduced in trace amounts to facilitate the interpretation of data. The products of the reaction were separated by paper chromatography. The fractions were analyzed by their reaction to urea-phosphoric reagent and for the presence of radioactivity. There is good evidence to support the hypothesis. The functosyl transfer mechanism is in operation in cell free extracts of several human oral streptococci. The reaction seems to follow the scheme postulated by other investigators for other organisms.

INTRODUCTION

In 1943, a group at the Hebrew University, Hadassah Medical School in Jerusalem, Israel, (Hestrin, Avineri-Shapiro and Aschner, 1943) isolated the enzymes responsible for levan synthesis in *Aerobacter levanicum, Bacillus subtilis* and *Bacillus polymyxa.* It was this group that coined the name "levansucrase" for this system. Other investigators discovered levansucrase systems (Bell, and Dedonder, 1954, Fuchs, 1956) in phytopathogenic Pseudomonas species.

A very important discovery in the investigation into the mechanism of transfer of fructose units to a developing polymer came when it was found that yeast and mold invertase produced oligosaccharides, as well as splitting sucrose into glucose and fructose, and it was realized that this enzyme was a transfructosylase rather than a simple hydrolase. Glucose and fructose resulted when water acted as the acceptor for the glucosyl and fructosyl units. It was determined by investigators, working with various genera of levan producers, that here, too, was a transfructosylase in action. (Hibbert and Braun, 1931; Niven, Smiley and Sherman,1941;Doudoroff and O'Neal, 1945; Hehre, Genghof, and Neill, 1945; Bacon and Edelman, 1951; Murphy, 1952, Pazur, 1952; Barker and Stephens, 1954; Bell and Dedonder 1954; Peaud-Leonoel, 1955; Fuchs, 1956; Avigad and Feingold, 1957; Dedonder, 1958; Howell, 1967).

Many publications—in particular those of Hestrin and his co-workers from Hebrew University, Peaud-Lenoel from the Pasteur Institute in Paris, France, and Fuchs from Waltman University in the Netherlands—have furthered comprehension of the mechanisms of fructosyl transfer by levansucrase. It has been found that in addition to the formation of a highweight polymer, the enzyme can also effect a reversible transfer of a beta-D-fructofuranosyl unit from an alpha-aldoside to the oxygen of the anomeric carbon of an acceptor aldose if the monosaccharide acceptor has a configuration in which the C2 hydroxyl group is *cis* to the

hydroxyl group of C1 in the alpha position and C3 is *trans* to the C1 position. (Peaud-Lenoel, 1955; Feingold, Avigad and Hestrin, 1957; Fuchs, 1959). In every case the reaction took this form:

$$fr \sim R^{1} + R^{11} \leftrightarrows fr \sim R^{11} + R^{1}$$

(eq. 1) where R^1 was the donor aldoside and R^{11} was the acceptor aldose; fr $\sim R^1$ and fr $\sim R^{11}$ represented an alpha-glycopuranosyl-beta-D-fructofuranoside reactant and product, respectively. It has been hypothesized that the substrate possesses a sufficient energy store for the reaction by virtue of the presence of the substituent on the anomeric carbon.

Streptococcus salivarius has been neglected in studies of this system, probably because it is not highly pathogenic. However, evidence has been growing steadily that human oral streptococci play an important etiological role in dental caries. (Sognnaes and Wislocki, 1950; Snyder, Hackedorn, Martin and Johnston, 1960; McDougall, 1964; Wood, 1964; Carlsson, 1965; Krasse, 1965 and 1967; Zinner, Jablon, Aran and Saslaw, 1965; Gibbons, and Socransky, 1962; Gibbons, Berman and Knoettner and Kapsimalis, 1966; Gibbons and Banghart, 1968; and Toto, 1967). This evidence points the finger of blame at the extracellular polysaccharide elaborated by these organisms, which contributes to plaque. The purpose of this study is to determine if the levansucrase system of *Streptococcus salivarius* operates in the same fashion as levan producers of other genera and if this microorganism will also catalyze a reaction like the one in equation 1?

Raffinose has been used as a fructosyl donor by all levansucrase investigators. This trisaccharide has a distinct advantage over other donors in any study of this reaction for the following reasons. That different aldoses compete for the fructosyl unit in the reaction has been shown by their inhibitory activity on levan formation (Fuchs, 1959). Melibiose competes less effectively than glucose. The competitive advantage of glucose would favor the formation of sucrose in the following reaction:

$$\underset{\text{(Raffinose)}}{fr \sim \text{melibioside}} + \text{glucose} \leftrightarrows \underset{\text{(Sucrose)}}{fr \sim \text{glucoside}} + \text{melibiose} \quad \text{(eq. 2)}$$

Also, melibiose is a 1,6 linked disaccharide and, therefore, would have a different chromatographic mobility from the 1,2 linked sucrose. This difference would facilitate separation of the glycosides.

Levan formation, according to Hestrin (1958) is effected by the displacement of the D-glucose group from sucrose by the enzyme as a first step. If this is the case, then no glucose should be found in the levan produced. On the other hand, Fuchs (1959) suggests that the polymer builds on a sucrose foundation.

If the *Streptococcus salivarius* levvansucrase system conforms to the pattern established for other organisms, then C^{14} labelled glucose should be found in sucrose. The presence or absence of glucose in any levan formed should clarify the action of the enzyme in the first step of polysaccharide synthesis.

Streptococcus salivarius is thought to possess an exocellular levansucrase system (Horsfall 1951, Hehre 1945, Fuchs 1959). Several methods of preparation of a cell-free enzyme system from microorganisms with an exocellular activity have been used

by other investigators. Hestrin, et al, (1943) used the property of *Bacillus subtilis* to diffuse enzymes into agar. Others (Harrison, Tarr, and Hibbert, 1930; Doudoroff and O'Neal, 1945; Hehre, 1945; Horsfall, 1951; Mattoon, Holmlund, Schepartz, Varva and Johnson, 1955) working with either a *Bacillus* species or *Streptococcus salivarius* used the cell-free supernatant without further purification. Peaud-Lenoel and Dedonder (1955, 1957) obtained a highly purified levansucrase preparation of *Bacillus subtilis* with 65-85% saturation with ammonium sulfate and subsequent electrophoresis of the precipitate on an agar column. However, they judged that much of the activity was lost in the purification.

Excessive turbidity and clumping do not appear in sucrose grown cells until after 12 – 24 hours of growth. This property would indicate that the enzyme system is adaptive and that the enzyme is elaborated in stationary phase of growth. Fuchs (1959) noted that levan-forming Gram-positive bacteria afforded cell free extracts which were able to produce levan only if the organisms were cultivated in sucrose containing media. Peaud-Lenoel and Dedonder (1957) state that with the disappearance of sucrose from the medium in their *Bacillus subtilis* cultures rapid breakdown of levansucrase took place.

MATERIALS AND METHODS

Source of Organisms: Representative strains of Gram positive streptococci of human origin were utilized. ATCC 9222 *Streptococcus salivarius* (Gunsalus strain) from American Type Culture Collection, Rockville, Md.; 14388A isolated from a deep carious lesion in the clinic of the Baltimore College of Dental Surgery; SB3 and CP3 isolated in this laboratory from human saliva.

Method of isolation: All samples were streaked onto mitis-salivarius agar (BBL-01-340) and incubated at 37°C. The development of a clear blue mucoid colony was considered characteristic.

Enzyme preparation: A loopful of each colony was introduced into 100 ml Trypticase #1 medium (Barry and Provenza, 1963) which contains 5 g. Trypticase (BBL-01-142), 2 g sucrose, 1 mg thiamine HC1, 1.5 mcg Vitamin B_{12}, 100 ml distilled water (pH 7). Cultures were incubated at 37°C for 30 hrs. At 30 hrs. all organisms would be in stationary phase.

The 30 hr. cultures were centrifuged (IEC centrifuge) at 10,000 rpm for 20 min. to remove the cells. The supernatant served as the enzyme source.

In order to study sucrose synthesis, a more concentrated enzyme solution was required. Also, the presence of unmetabolized sucrose in the medium would have interfered with the interpretation of the data. Therefore, in the preparation of the extract for these studies the cell free supernatant was dialyzed for 18 hours against running tap water to remove all soluble sugars. The dialysis bags were then placed on aquacide for 20 hours to remove the excess water and concentrate the enzymes.

A few drops of chloroform with thymol (25 g thymol per 200 ml chloroform) were added to the dialyzates to prevent bacterial contamination. The extracts were then stored in the refrigerator until needed.

Reaction mixture: 1 ml Trypticase #1 media (without sucrose) containing 2.5% raffinose and 6.0% glucose; 1 ml 0.1 M phosphate buffer—pH 6.3; and 1 ml of the enzyme solution.

The raffinose and glucose were sterilized by filtration through fritted glass filters. The sterile sugars were then added to the sterile Trypticase #1 medium. The control contained 1 ml distilled water replacing the enzyme solution. 0.8 ml of glucose-UC^{14} was added to each tube. (Radioactivity per tube = 16 microcuries). A few drops of chloroform with thymol were added to each tube to prevent bacterial contamination.

Procedure: The reaction mixture was incubated at 37°C for 2 hours. A spot (approximately 0.5 cm diameter applied 4 times) of each mixture was applied to Whatman #1 chromatography paper. The solvent was: n-butanol, ethanol, and water, (4.0/ 1.1/ 1.9 by volume; Peaud-Lenoel 1955). After 68 hours, the ascending chromatogram was dried and sprayed with urea-phosphoric acid reagent (Wise, et al 1955). A circular sample (13 mm diameter) was cut from the concentrated portion of each spot indicated and from a portion within the solvent area lying ahead of the most distant sport developed. These samples were tested for the presence of radioactivity with a thin-window continuous gas-flow G-M detector.

Three volumes of ethanol were added to the remaining samples and permitted to stand overnight in the refrigerator. Each solution was centrifuged for 20 mins. at 12,000 rpm. The supernatant was decanted off. One ml of 10% sodium acetate was added to the precipitate. After mixing the polysaccharides dissolved, while the proteins remained as residue.

Aliquots (0.03 ml in volume) of the original supernatant and of the dissolved polysaccharides were tested for radioactivity by means of a thin-window continuous gas-flow G-M detector.

RESULTS

The results are summarized in tables 1 and 2 (see pages 33 and 34).

The urea-phosphoric acid reagent used to develop the chromatogram (reproduced in Figure 1), shows a characteristic blue-gray color in the presence of a ketose unit. Aldoses give a brown spot.

The sample (S) taken from the solvent area in advance of the most distant spot developed gave an average count about equal to the background count. Radioactivity was greatest in those spots fartherest from the starting line (A). In all the experimental samples this spot was blue-gray in color. The control was brown. The second fastest moving spot (B) was very faint in all the experimental samples and was absent in the control. The radioactivity measured in these spots was in all cases, except CP3, significantly more (67%) than the radioactivity measured at the starting line, but 33% or less than the spots designated A. The slowest moving spot (C) was the trisaccharide raffinose. In every case, including the control, there was only a slight increase in radioactivity associated with this spot when compared to the starting line data. The solvent system used does not move a polysaccharide. It is reasonable to assume that the intense blue-gray color of the spots at the starting line (D) in each of the experimental samples results from the

presence of a polyfructan. Spot (D) was absent in the control. The radioactivity associated with this area was not significantly different in experimental samples and the control.

The addition of three volumes of ethanol to the reaction mixture afforded a supernatant (A in table 2) and a precipitate redissolved in 10% sodium acetate and designated B in table 2. The B fraction contained less radioactivity per aliquot than did fraction A. However, all experimental samples of the B fraction contained as much or more than 80% more radioactivity than the control. These results suggest the presence of a glucose moiety in the polysacharide formed. Fraction B represents a better sample than fraction A because measurement was more precise and the aliquot was removed from a smaller total volume. This might be a factor in the variability seen in the B/A ratio shown in Table 2. Although variable, there is still a significant difference in ratios seen in the experimental group when compared to the control.

DISCUSSION

There seems to be good evidence that the fructosyl transfer mechanism is in operation in cell free extracts of several human oral streptococci. This reaction apparently follows the scheme postulated by the aforementioned investigators in their work with other bacteria.

The levansucrase system of the organisms tested in this study does not seem to follow the pattern suggested by Hestrin (1958). The presence of C^{14} in the dissolved precipitate, as cited in Table 2, contradicts his hypothesis. Perhaps, this polymer builds on a sucrose foundation as suggested by Fuchs (1959). The presence of glucose in the levan as demonstrated by data in Table 1 (area D) is not so significantly different for experimental samples and control. The follow-up studies with all strains under investigation may clarify this situation.

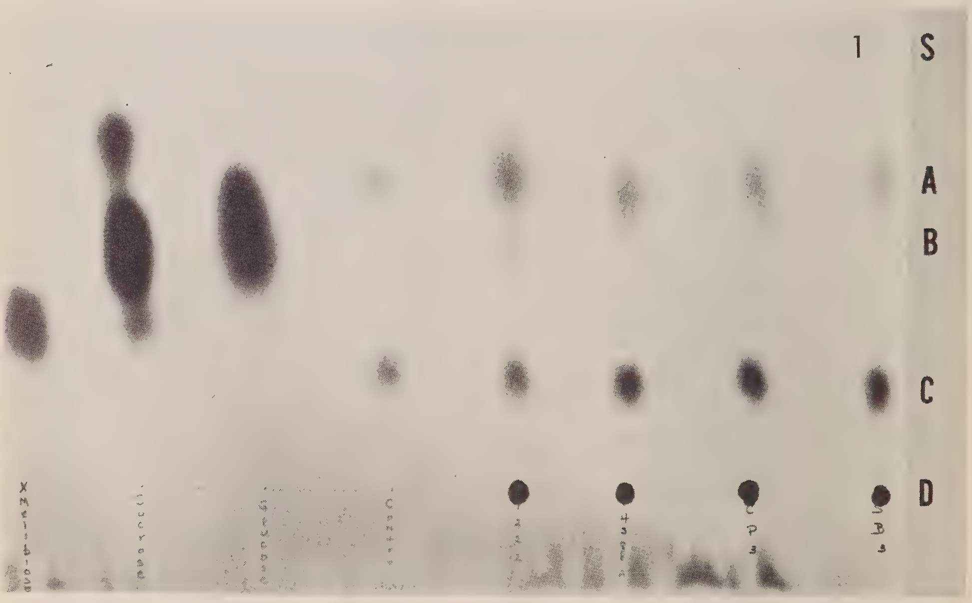

FIG. 1. Chromatogram of several reaction mixtures containing cell-free extracts and media with raffinose and glucose. From left to right samples are: Melibiose, sucrose, glucose, control (without enzyme), 9222, 14388A, CP3 and SB3.

TABLE 1

Radioactivity, expressed as average counts per minute, as determined by a continuous gas-flow G-M detector, found in circular samples cut from spots developed by urea-phosphoric acid reagent on an ascending chromatogram (Solvent: n-butanol, ethanol, water 4.0 / 1.1 / 1.9, by volume

Background count = 21 cpm

*S = solvent area above "A"
A = area of fastest moving spots
B = area of second spots
C = area of slowest moving spots
*D = starting line

Organism	*Location of circular sample* cut from paper chromatogram*	*Presence of ketose unit indicated by blue-gray color*	*Average counts /min.*
——	S	—	23
SB3	A	+ +	467.9
	B	±	152.3
	C	+ +	52.3
	D	+ + + +	54.1
CP3	A	+ +	671.9
	B	+	94.2
	C	+ +	53.3
	D	+ + + +	51.1
14388A	A	+ +	986.2
	B	+	139
	C	+ +	62.2
	D	+ + + +	50.8
9222	A	+ +	598.3
	B	+	156
	C	+ +	67.5
	D	+ + + +	51.8
Control	A	—	795.5
	B	—	63.0
	C	+ +	57.8
	D	—	42.5

TABLE 2

Radioactivity found in two components of reaction mixture twenty hours after addition of three volumes of ethanol.

Background count = 25 cpm

Organism	A. *Supernatant average cpm*	B. *Redissolved precipitate average cpm*	*B/A*
SB3	4825.3	3124.0	.654
CP3	5938.3	3041.4	.512
14388A	8529.0	3139.0	.368
9222	6928.0	2967.3	.427
Control	7984.3	580.3	.073

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The Clinical Implications of Oral Habits of Compulsion
(Teeth and Tension-Attention)

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The informed practitioner of dental science recognizes that bacterial plaque (microcosm) and calculus are probably the principle causes of inflammatory periodontal disease. Gingivitis is the "prlmary" lesion in periodontal disease; this incipient lesion, if not controlled, may lead to extensive pathological changes in the periodontium. The validity and importance of the aforementioned factors in the etiology of periodontal disease is not to be denied; however; a predisposing factor which, if not recognized and controlled, creates an environment that has the potential of reducing the patient's adaptive capacity to such an extent that the rate and degree of the degeneration of the supporting structures is maximized. This factor is the subject of the following discussion.

The role of harmful oral habits, with their actual or potential damaging effects on the periodontium has been well documented in the literature. What constitutes harmful oral habits, and what is the mechanism of their action? Sorrin (1935) has conveniently classified many of the harmful oral habits in three categories:

1. Habit neuroses— lip biting, tongue thrusting, pen and pencil biting, (clenching, grinding and gritting the teeth).
2. Occupational—holding pens or nails in the mouth, pressure of the reed on a musical instrument, thread biting.
3. Miscellaneous—mouth breathing, thumb sucking, pipe smoking, tobacco chewing, cigar chewing, incorrect method of toothbrushing.

What makes these oral habits harmful? Because these types of habit patterns are essentially nonfunctional by orthodox definition, they create force vectors which the "oral organ system" cannot control on a physiological basis and thus they may become an irritant as significant as "plaque". Essentially, functional movements of the mandible occur during speaking, swallowing (deglutition), and masticatory action. The forces generated by functional movements are transmitted in a coronal-apical direction by the inclined planes of the teeth, through the long axis of the teeth into the periodontal ligament and to the subjacent and contiguous structures. The morphology of the "attachment apparatus" is such that forces directed in this fashion are optimally received and physiologically dissipated. Non-functional forces generated by most oral habits create force vectors that are not directed coronal-apically, but laterally; because of the anatomy of the attachment apparatus, these forces have the potential of causing a degenerative lesion known as "the lesion of occlusal trauma" and pre-

dispose the periodontium to become more susceptable to the local environmental factors conducive to inflammatory periodontal disease, by constantly stressing the area. Force now has become an irritant because of being generated by the non-functional movements of the "oral habit pattern syndrome". This irritant has the potential of becoming as pathogenic as any of the inflammatory pathogens.

The "oral habit pattern syndrome" produces the visualized or suspected oral habit pattern as a result of the patient trying to compensate to some other stimulus, which may be emotional or physical in origin. One might consider the "oral habit syndrome" as a compensatory reaction on the part of the individual by his stomatognathic system. One might also be aware that to interfere with this compensatory reaction may cause the irritant to manifest itself in another organ system. The dental therapist is then faced with the dilemma of not only controlling the result of this "syndrome" but in trying to recognize its etiology. In this regard, intercourse between other health science disciplines may be necessary to achieve an optimum therapeutic result.

Two examples may serve to illustrate this concept. An individual under emotional stress may attempt to compensate by developing clenching or bruxing patterns. The result of this may be damage to the periodontium or muscle spasm which is a common manifestation of temporomandibular joint dysfunction syndrome. An acute exaccerbative inflammatory lesion (periodontal abscess) may create compensatory habit patterns, which are a result of the patient's attempt to counter-irritate a noxious stimulus. Whatever the initiating factor, whether emotional or physical, the resulting habit pattern has the potential to cause significant pathoses to the stomatognathic system.

The therapist must make a valued judgment as to whether the oral habit under consideration is causing pathoses or whether it is conducive to pathoses. Does he wish to take the course of watchful waiting, at the same time being careful of not inadvertently being guilty of supervised neglect, or simply initiating therapy based upon his ability to demonstrate a habit pattern? It is the belief of the authors that no therapy should be initiated in the absence of pathology, but it is encumbent on the clinician to recognize the *incipient lesion* which is usually reversible and to deliver treatment immediately upon its recognition. To interfere with an oral habit pattern in the absence of some demonstrable pathoses may cause the patient not to compensate, resulting in the initiation of a physical manifestation in some other organ system of the susceptible individual.

In order to explore the above concept we may limit our discussion to an analysis of "bruxism", a habit pattern that would be considered under the classification of occlusal neurosis. This selection is intentional, because it is, perhaps, the most prevalent of the habits. It is possibly the most damaging to the periodontium, and it is unquestionably the most frequently overlooked by the patient and the dentist.

Bruxism is the grinding of the teeth for non-functional purposes. Nadler (1959) states "that bruxism is the grinding or clenching of the teeth at all other times than

for normal uses". Normal use of the teeth refers to mastication, swallowing and speech. The total normal use of the teeth results in tooth contact for possibly two hours per day. The contacts for the most part are of a fleeting nature. The functional forces are optimally distributed, mutually by the occlusal surfaces of the posterior teeth and the incisive surfaces of the anterior teeth, in a coronal to apical direction. In bruxism, on the other hand, tooth contacts may be continuous, and heavy for extended periods of time, with the force vectors generated in lateral direction. Less than 25 pounds of occlusal pressure is exerted by the average patient during mastication and swallowing. In bruxism, a maximum biting force of 200-300 pounds is possible (Anderson, 1956). Accordingly, in a bruxing habit we are confronted with abnormal increases in the magnitude, the frequency and duration of occlusal forces. These abnormal occlusal forces, in turn, cause "overloading" and the "sum vector of forces" are dispersed in an unfavorable direction on the teeth and periodontium. The potential generation of these traumatogenic forces is conducive to pathology.

During the course of patient examination, the practitioner should be mindful of these abnormal forces, and view them with alarm and caution. This is especially important in those patients which are susceptible to inflammatory periodontal disease. The superimposition of untoward force can do nothing but aggravate the present disease process. *A failure to be cognizant, or recognize pathologic force patterns, could result in a dentition destroying itself during the course of what otherwise might be considered skillful dental care.* In addition to playing a leading role in the pathogenesis of occlusal trauma and periodontal destruction, bruxism also shares a part in causing symptoms or injury to other members of the stomatognathic system, namely the teeth, temporo-mandibular joint, and muscles of mastication.

Bruxism is thought by many to have a psychogenic background because clamping and grinding are compulsive acts which manifest in an oral outlet for emotional tension, anxiety, and deep seated aggression (Goldman and Cohen, 1968). Others feel the habit may be initiated because of occlusal imbalance whether iatrogenic or naturally occurring. The bruxing pattern represents an unconscious effort on the part of the patient to reduce the "discrepancy". The clinician should suspect both factors in the etiology of this problem.

The prevalence of bruxism is thought to be high. It is not limited or peculiar to any age group, race, sex or geographical area. The incidence is probably higher in areas where the population is constantly subjected to tension. Epidemiologic studies to determine prevalence would not be reliable because most affected persons are unaware of the habit and its effects; therefore, they do not seek treatment. The indices used in most studies of periodontal disease are concerned with the inflammatory aspects of the disease at this time. To further make it difficult to arrive at a true index is the failure of the practitioner to associate bruxism with either the presence or severity of periodontal disease.

What aspects of bruxism are we concerned with in the clinical practice of dentistry? We are concerned with clenching and grinding if done over an extended period because it could create forces greater than experienced during normal functional movements this has the potential of inducing pathology. If pathology does result from these afunctional conditions it is called "periodontal traumatism" or "trauma from occlusion". This trauma is seen clinically by mobility, pathological or retrograde wear of the teeth, fractured cusps of the teeth, unusual recessive patterns due to resorption of the thin cortical plates of bone, and may even manifest in hypersensitive responses. Characteristically, depending upon the adaptive capacity of the individual, there are either quantitative and/or qualitative changes in the attachment apparatus. The extensiveness of the degenerative phenomena determines the reversability of the lesion even if the irritant is controlled or removed. It should be clearly stated that trauma from occlusion will *not cause* the periodontal pocket or gingivitis, although, it can and most often does, aggravate or predispose the periodontium to breakdown from the principle pathogens thought responsible for inflammatory periodontal disease. Indeed, the combination of these two insults, the inflammatory lesion of periodontal disease plus the added injury due to occlusal trauma could explain the rapid and bizarre pattern of alveolar bone resorption that is often encountered in daily practice.

It is often difficult to get an accurate history of bruxing from a patient; the acts are repetative in nature; therefore, constantly being reinforced on a subconscious level. Many patients are totally unaware of the problem until subjective or objective signs or symptoms ensue.

In many cases the dentist must make the diagnosis based on judgment as much as the clinical presentation, radiographic evidence and history of the patient. Normal diagnostic criteria should substantiate the clinician's "intuition". Clinically, the examination should include the following:

1. A testing of the mobility of each and every remaining tooth.
2. The presence and degree of occlusal wear.
3. Recognition of splaying or moving teeth.
4. Hypersensitivity of the teeth.
5. Tenderness to palpation of the muscles of mastication.

Any or all of these clinical findings, particularly mobility, are significant when present, and should raise the clinician's "index of suspicion" to alert him to the possibility of bruxing habits.

Radiographic evidence should be correlated to clinical findings. Tooth mobility resulting from bruxing habits invariably will show classic signs of the lesion of occlusal trauma; widening of the periodontal ligament space, and a loss of lamina dura if trauma exists. Occlusal trauma from bruxing usually results in a distinctive pattern of alveolar resorption. The crestal resorption is of the vertical, rather than the horizontal type; and it is usually of a marked degree. Hyperfunction may be seen radiographically as manifest by thickened lamina dura and thickened periodontal ligament space. This may be considered as a "pre-

traumatic" lesion. If the irritant is not removed and the adaptive capacity of the individual cannot compensate the lesion of occlusal trauma may result.

Treatment of bruxism is directed at early recognition of the habit pattern and towards mitigating and minimizing its harmful effects. The habit itself, if psychogenically initiated, is not in the dentist's area of therapy to treat, but even so, is difficult to eliminate. A satisfactory result can be achieved by protecting the dentition and its supporting and contiguous structures from the deliterious affects of these habit patterns. One would be wiser to treat or prevent the result of the habit, rather than try to eliminate the caüse of its initiation. A thorough and detailed occlusal analysis is indicated which includes accurate transference of study models to an adjustable articulator using a centric relation bite to orient the mandibular cast to the maxillary cast. Where occlusal interferences are conditioning the habit reflex, their elimination is indicated both in the centric path of closure and in excursive and protrusive glide patterns. If there has been significant quantitative loss of attachment apparatus, buccolingual narrowing (reduction of functional crown to root ratio) is indicated. The correction of occlusal imbalances should be correlated with any other indicated periodontal therapy.

Following occlusal adjustment by selective grinding, *if* it is indicated, an acrylic "nite or bite" guard should be fabricated for the patient. This appliance will redistribute pathological forces of occlusion, act as a transitional splinting appliance, prevent excessive wear of the teeth, stabilize the teeth, prevent interferences in lateral excursions, interfere or disorient the secondarily conditioned reflexes due to the proprioception of tooth contact, and interfere with the muscle spasm of the hypertonic muscle fibers by changing their tonicity.

It is the opinion of the authors that oral habits of compulsion which are often unrecognized potentiate the pathogenic effects of periodontal disease by superimposing force as an irritant. It is this insidious "pathogen" that prevents control of advanced periodontal pathology despite the sophisticated armenatarium of surgical procedures available to eliminate the architectural and inflammatory pathology of the lesions. The purpose of this discussion was not to introduce a new or "startling" concept of periodontal pathogenesis, but to orient the clinician of the absolute need to recognize another paramount factor that predisposes an otherwise healthy patient to become susceptable to the pathogens that are normally present within the dental organ system. To ignore its role could invite disaster; to give "attention" is but an exercise of our professional responsibility.

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CONTENTS

Some Observations On The Clinical Handling And Stability of Elastomeric Impression Materials

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Some Observations On The Clinical Handling And Stability of Elastomeric Impression Materials

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Introduction

Many laboratory investigations have been carried out on elastic impression materials in determining, for example, the setting characteristics (Braden 1966, Braden and Elliot 1966, Wilson I 1966), elasticity (Mac Pherson 1967, McLean 1958, Wilson II 1966) and dimensional stability (Hosoda and Fusayama 1961, Custer, Updegrave and Ward 1964). The results of such tests are of value to clinicians in providing information for the use and manipulation of the materials.

Standardized laboratory dies which bear little resemblance to clinically prepared teeth have been used in most tests (Hosoda and Fusayama 1961, Tomlin and Osborne 1958, Schnell and Phillips 1958). However, dies resembling clinically prepared teeth are considered to be more relevant since they are frequently more complex than standard dies and any discrepancies which occur in castings become correspondingly more pronounced.

Schnell and Phillips (1962) indicate that such dies may be used to produce valid results in comparing different materials or variables associated with accuracy and that larger non-anatomical dies have no advantage over smaller anatomical models.

In contrast to the use of tests which measure the properties of the material only, the cumulative effect of variables in clinical procedures may result in discrepancies in impressions becoming apparent when such a method is employed. In order to assess several impression techniques, comparative tests have been carried out on a series of impression materials using dies that were actual examples of clinical preparations.

Materials and Methods

Dies were produced by cutting conventional preparations in natural teeth and preparing molds of these in Vinamold*. Wax patterns were poured in the molds and cast in cobalt-chromium alloy.

Part I

Three impression techniques were used with a die of an M.O.D. cavity in a bulbous maxillary first molar with a reduced mesio-buccal cusp and a disto-lingual extension. This was mounted in stone and used for impressions with individual metal bands. A gold master casting was prepared and seated on the die with no marginal deficiencies.

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*Vinamold H.M.C. 1028, Vinatex Limited.

Technique 1

Impressions were taken in an oversized copper band, closed at one end with a soldered copper flange. The flange was gripped in removing the impression from the die. The manufacturers adhesive was used with the polysulphide and small perforations provided retention for the silicone elastomers.

Technique 2

An aluminum shell* was used to carry the materials in the second series. This was reinforced with composition to minimize distortion of the shell during removal of the impression. The same methods of retention were used.

Technique 3

Heavy gauge aluminum caps from microbiological culture medium tubes were used to support the material and ensure rigidity. A hole was drilled through the top of each cap to permit excess material to escape and through which a metal loop was passed to permit removal without grasping the cap.

**KRI, Pharmachemic AG, Zurich.*

The impression materials used in Part I Tests are listed below:—

Code Letter	Material	Type	Manufacturer
A	Permlastic	Polysulphide	Kerr Mfg. Co.
B	Neoplex	”	Surgident Ltd.
C	Elite	”	F. H. Wright Dental Co. Ltd.
D	Verone	Silicone	Davis, Schottlander & Davis Ltd.
E	Lastic 55	”	A. Kettenbach
F	Siliflex	”	Flexico Ltd.
G	Impressil	”	Imperial Chemical Industries
H	Lastic Rod	”	A. Kettenbach
I	Cardex	”	Messrs. Cardex

In all cases the proportioning of pastes and liquids as specified by the manufacturers was carefully observed. Mixing times were controlled to 45 seconds for polysulphide and 30 seconds for silicone elastomers. Total manipulation time from commencing spatulation to seating the impressions did not exceed 90 seconds *(Myers 1958)*.

After curing, the impressions were either poured immediately, stored for sixteen hours before pouring, electroplated for sixteen hours in acidified copper sulphate solution or electroplated for four hours in basic silver cyanide solution before pouring.

Part II

The cobalt-chromium dies for the Part II Tests were mounted as bridge abutments as shown (Fig. 1). A three unit one piece gold casting of the retainers with a simple bar pontic was made to fit accurately on the dies.

In order to reproduce a given bulk of impression material between tray and dies in successive impressions, duplicated trays were prepared. Sheet polystyrene 1/8″ thick was vacuum molded in a Wenvac machine* over stone models to give a clearance of 1.5 to 1.8 mm. between tray and dies.

The elastomers were manipulated as in Part I, with 30 seconds allowed for the polyether rubber and were immersed in a water bath at 37° C immediately after seating the tray. Polysulphides were allowed ten minutes curing and silicone and polyether elastomers six minutes before removing the impressions. These were poured in Velmix stone at 1, 6, 24 and 48 hours, intervals which may be encountered in practice after pouring in the surgery or alternatively dispatching to commercial laboratories.

**The Wenward Co. Ltd.*

Results and Discussion

The clinically acceptable and unsatisfactory results obtained in Part I are listed in Tables 1 and 2 respectively. During these Tests, some observations were noted in the use of the Diamond Die material.

The correct consistency is dependent on the very careful use of the measures supplied. The working time from commencing the mix until flow ceases is 3½ minutes and the material is very difficult to vibrate satisfactorily into the impression. After the recommended setting time of 1 hour, when the die is removed from the impression for firing, the material is brittle. The margins of the die are particularly prone to fracturing on removal from polysulphide impressions.

The general trends observed in Part I Tests were as follows:—

1. The most satisfactory results were obtained with silicone and polysulphide materials by pouring dies immediately in Velmix stone or Diamond Die. The stone dies were more acceptable in view of the friability of the Diamond Die before firing.
2. Metal bands could not be located accurately around the master die, with consequent difficulty in removal and distortion of the unreinforced copper bands.

3. The distortion observed after silver plating silicone elastomers was most marked in the cuspal region. Possible causes of this are rebound recovery of a greater bulk of impression material in this region, and a relatively greater amount of polymerization contraction (Fig. 5).

4. During the 16 hours taken for copper plating, the continuing polymerization of the impression materials resulted in gross distortion observed on the dies. The distortion was even more marked, particularly in the cuspal region where the metallic deposit is thinnest, when the plated impression was poured in autopolymerizing acrylic resin.

The materials used in Part II Tests are listed below:—

Code Letter	Name	Type	Manufacturer	Batch
J	Permlastic Regular	Polysulphide	Kerr Mfg. Co.	283C72
K	Elite Regular	”	F. H. Wright Dental Co. Ltd.	A 136 B 134
L	Galt Regular	”	Astra-Hewlett Ltd.	80540
M	Neoplex Regular	”	Surgident Ltd.	17668
N	Rubberjel Regular	”	L. D. Caulk Co.	12267
O	Lastic 55	Silicone	A. Kettenbach	0821
P	Jelcone Regular	”	L. D. Caulk Co.	26566
R	Caledonian	”	F. H. Wright Dental Co. Ltd.	—
S	Impregum	Polyether	E.S.P.E. Seefeld/ Oberbay Germany	1164 0384
	Velmix Stone	—	Kerr Mfg. Co.	184C346

5. In view of the very small amount of distortion occurring during silver plating Material A, the procedure is favored on account of the hard surfaced die which offers the advantage of completely finishing a casting in the laboratory. This becomes a major consideration in bridgework since abrasion and consequent inaccuracies may occur in repeatedly removing and replacing the retainers on stone dies.

The results of Part II Tests are given in Table 3. Difficulty was encountered in handling the viscous regular bodied polysulphides owing to the unintentional incorporation of air voids in loading the trays. The syringe technique would have been preferred if light bodied material had been available for all polysulphides used. The handling characteristics of the polyether materials were similar to those of silicone elastomers; it was easy to proportion and spatulate, with a pleasant color and odor. When cured the material was very rigid and the need for a 3 mm. spacer as recommended became apparent.

Only one of the selected impression materials in Part II gave dies showing gross discrepancies on seating the master casting, after standing for 24 hours before pouring the dies. This same silicone elastomer failed to give satisfactory results regardless of time interval before pouring the dies.

All polysulphide impression materials gave satisfactory results up to and including 24 hours standing before pouring in Velmix stone. In some cases errors became apparent at 48 hours. The minimum uniform bulk of material supported by a rigid tray is considered to limit distortion caused by continuing polymerization.

The silicone elastomers were found to be less reliable. Clinically satisfactory results were obtained after standing for one hour, and in the case of Material O, after 6 hours. The most interesting observation in Part II Tests was that the relatively rigid polyether Material S gave consistently better results than all other impression materials tested.

Recommendations

1. When the individual band impression technique is selected, the band must be reinforced with impression compound or cold-curing acrylic resin to prevent distortion of the band on removal from the prepared tooth.

2. A specially prepared closely adapted tray is a more reliable method of obtaining accurate impressions with elastomeric materials.

3. The selection of polysulphide materials tested differed little in dimensional stability. Two were most satisfactory when poured within the hour and two remained satisfactory up to 48 hours.

4. The silicone materials proved less reliable, only one being satisfactory for as long as six hours.

5. The recently introduced polyether material was more reliable with regard to dimensional stability than all the other materials tested.

TABLE 1

Clinically satisfactory impressions from Part 1.

Impression Material	Techniques	Plating	Interval	Die Material	Fit
A	1, 2 & 3	-	-	Velmix	++
A	1 & 3	Silver	4 hours	"	+
A	1 & 2	-	-	Diamond Die	++
A	2	Silver	4 hours	Velmix	++
A	2	-	16 hours	Diamond Die	+
A	3	-	-	"	+
B	3	-	-	Velmix	++
B	3	-	16 hours	"	+
B	3	-	16 hours	Diamond Die	+
C	3	-	-	Velmix	++
C	3	-	-	Diamond Die	++
D	1 & 3	-	-	Velmix	++
D	1	Silver	4 hours	"	+
D	3	-	-	Diamond Die	++
E	1	-	-	Velmix	+
E	2	-	-	"	++
E	2	Silver	4 hours	"	+
E	2	-	-	Diamond Die	++
E	2	-	16 hours	"	+
F	3	-	-	Velmix	+
F	3	Silver	4 hours	"	+
F	3	-	-	Diamond Die	++
G	3	-	-	Velmix	++
G	3	-	-	Diamond Die	++

++ Indicates a perfect fit (Fig. 2)

\+ Indicates a slight discrepancy which would be clinically undetectable.

TABLE 2

Clinically unsatisfactory impressions from Part 1.

Impression Material	Technique	Plating	Interval	Die Material	Fit
A	1	Copper	16 hours	Velmix	-
A	1	"	16 "	Acrylic	--
A	1	Silver	4 "	Acrylic	--
B	3	"	4 "	Velmix	-
C	3	"	4 "	"	-
D	1	Copper	16 "	"	-
D	3	-	48 "	"	--
E	1	Silver	4 "	"	-
F	1	-	-	"	-
F	1	Copper	16 "	"	-
F	1	Silver	4 "	"	-
F	3	-	16 "	"	--
G	3	Silver	4 "	"	--
G	3	-	16 "	"	-
H	3	-	-	"	-
H	3	Silver	4 hours	"	--
H	1.3	-	-	Diamond Die	--
I	1.3	-	-	Velmix	-
I	1.3	Copper	16 hours	"	--
I	1	Silver	4 "	"	--
I		-	16 "	"	--

— Indicates distinct discrepancies (Fig. 3)

— — Indicates failure to seat the casting (Fig. 4)

TABLE 3

Impression Material	1 Hour			6 Hours			24 Hours			48 Hours		
J	++	++	+	+	+	+	+	+	-	-	-	-
L	++	++	++	++	+	+	+	+	+	+	-	-
K	++	+	+	++	+	+	+	+	-	+	+	-
M	+	+	+	++	+	+	+	+	-	+	+	+
N	+	+	+	+	+	-	+	+	-	-	-	--
S	++	++	++	++	++	+	++	+	+	++	++	+
O	++	+	+	++	++	+	+	-	-	-	-	--
P	+	+	-	-	-	-	-	-	--	-	-	--
R	-	-	--	-	-	-	--	--	--	--	--	--

++ Indicates a perfect fit

+ Indicates slight clinical undetectable discrepancies

— Indicates distinct marginal discrepancies

—— Indicates a gross discrepancy

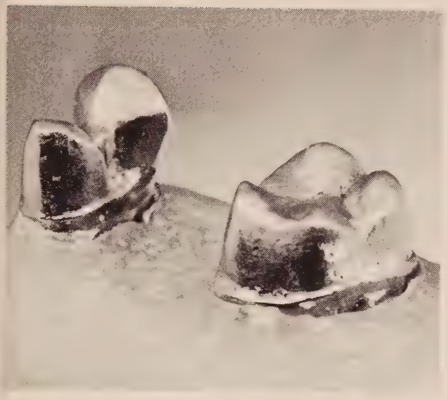

FIGURE 1

FIGURE 2

FIGURE 3

FIGURE 4

FIGURE 5

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LEGEND TO ILLUSTRATIONS

1. Cobalt-chromium dies of three-quarter and full veneer crown preparations mounted as bridge abutments for Part II tests.
2. Master gold casting seated on Velmix stone model illustrating good (++) fit.
3. Master gold casting seated on copper surfaced stone model illustrating poor (—) fit.
4. Master gold casting on copper surfaced acrylic model illustrating failure to seat (— —).
5. Section through an individual band impression illustrating uneven distribution of bulk of material.

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The Use Of Fluorescence Microscopy In Oral Diagnosis

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Since the creation of Eve, Man has been striving to better himself and the world around him. Scientific and technological advances have been able to decrease the time factor in such things as travel and production and increase the time factor such as in life itself. Instant coffee, a heart transplant and more recently landing a man on the moon could only have been accomplished by continued improvement of standard technics and exploration of new technics.

A problem in the teaching of clinical oral diagnosis is that the confirmation of a clinical diagnosis is not achieved without a time lapse. The necessity for slide fixation, prolonged tedious staining technics, relatively long delays between slide staining and final cytological screening, temporal and spatial schism created by department aligation between the clinician and the cytologist often delays the diagnosis and the institution of treatment. Many times a cytology report arrives after either the lesion has disappeared or healed and a biopsy already taken. If a tentative diagnosis of malignancy could be ascertained upon the patient's initial visit, immediate biopsy would be indicated. If microbiologists could classify bacteria directly from the tissue smear rather than isolating them through cultures, 24 to 72 hours could be gained in instituting the drug of choice. Think of how many lives could be saved if a method or methods of instant diagnosis could be used on patients. Maybe methods of instant diagnosis may never come about, but certainly easier, more efficient methods of diagnosis are just around the corner.

Considerable interest has been stimulated during the past few years in the use of fluorochrome dyes for the detection of malignant exfoliated cells (Bertalanffy, 1962; Conroy, 1961; Mela and Vercellino, 1966; Seydel, 1965; Umiker, 1961; Watanabe and Morita, 1963). Acridine Orange is a polychromatic dye capable of imparting fluorescent properties to both RNA and DNA with ultraviolet irradiation (McHugh and Persson, 1958). Riva and Turner (1962) have devised a new acridine orange staining technic which requires only 10 seconds. Their screening is done with relatively economical equipment and has the following advantages:

1. It lends itself readily as a screening procedure.

2. Smears are demonstrated with a clarity approaching that of conventional methods that were developed especially to show cell morphology.

3. Staining procedures are short and simple.

4. Slides can be destained in 50% alcohol and stained by another method.

5. Protozoan, fungal and bacterial infections are readily recognized.

6. Erythrocytes do not stain, therefore, blood and hemorrhage do not obscure field.

PROCEDURE

1. Fixation
   Smear can be stained unfixed or fixed with 95% alcohol.

2. Staining
   a. Three seconds agitation in a 0.025% solution of Acridine Orange.
   b. Three seconds agitation in a 2.0% alcohol in normal saline solution.
   c. Four seconds agitation in normal saline.

3. Cover slip with normal saline and examine immediately.

4. Screening and initial morphological interpretation is done at 100X. and final morphological study should be done at 400X.

DISCUSSION

The Acridine Orange staining technique has been used for approximately two years in the Oral Diagnosis Clinic of the University of Maryland and the results have been equally effective as the Papanicolau technique in the diagnosis of squamous cell carcinoma (Fig. 1). It has been an instant aid in the diagnosis of acute necrotizing ulcerative gingivitis (Figs. 2 and 3). Fungus infections are easily diagnosed directly from the smear (Figs. 4 and 5). Bacteria stain vividly red and can be identified as cocci, bacilli, etc. These broad classifications necessitate the need for further research which may someday enable us to classify them more definitively.

CONCLUSION

A rather recent method of examining cells and organisms by the use of fluorochrome dyes and examined under monochromatic light has been described. Fluorescence has introduced new criteria and methods for identifying cells and organisms.

Acridine Orange via the ten second staining technique is a fast, simple and useful aid in the diagnosis of oral lesions. I believe, the use of the Acridine Orange technique can be expanded and the classification of most oral organisms accomplished without the use of culture techniques.

(Full Color Illustrations
on Pages 18 and 19)

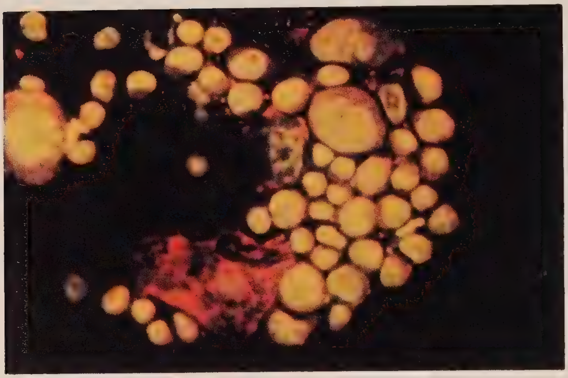


FIGURE 1

Exfoliated nuclei which exhibit all the criteria for malignancy.

Acridine Orange 400X.

FIGURE 2

Clinical photo of patient with Acute Necrotizing Ulcerative Gingivitis.

FIGURE 3

Smear taken from same patient showing fusiform bacilli, bacteria and Borellia Vincenti.

Acridine Orange 400X.

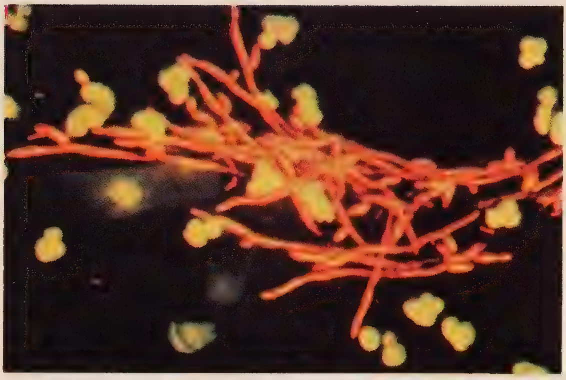
FIGURE 4

Clinical photo of patient with thrush on tongue.

FIGURE 5

Smear taken from same patient showing Hyphae and Spores of Candida Albacans.

Acridine Orange 400X.



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"Paralleling Technic For Intra-Oral Periapical Radiographs: Fight or Switch"

Donald L. Olson, D.D.S.[1]

During the past decade many of the dental schools in this country have begun to teach and recommend the use of the paralleling technic rather than the bisecting technic for intra-oral periapical radiography. Today the majority of dental schools have adopted this position. At the University of Maryland we also recommend the utilization of the paralleling technic and require that our students become proficient in its clinical application.

Why has this change occurred at Maryland as well as in many other dental schools? If we have changed, should you change your technic? If you should change, how can you accomplish it without disrupting your office procedure?

To clarify these issues, it is necessary to review some basic factors of radiographic technic and radiology which bear on the subject.

The objective of any radiographic technic is to obtain a radiographic image of the highest interpretive quality consistent with sound principles of radiation hygiene. The requirements of image quality are that (1) the image be sharp, (2) the image be shaped like the object and (3) the image be the same size as the object. Since the casting of a radiographic image on a film is very similar to the casting of shadows by light, it follows that the principles of light shadow casting also apply to radiographic image casting. If one bears in mind that a light beam and an x-ray beam possess some similar properties and characteristics, it may be easier to understand some of the basics in radiology.

There are five basic principles of shadow casting which govern the quality of the image produced. These can be stated in terms of dental roentgenology as follows:

(1) The size of the source of radiation should be small.

(2) The distance from the source of radiation to the tooth should be long.

(3) The distance from the tooth to the film should be short.

(4) The mean plane of the long axis of the tooth and the plane of the film should be parallel.

(5) The central ray of the beam of radiation should strike the tooth and film at a right angle.

The size of the source of radiation is determined by the manufacturer of the x-ray tube. It is impossible for this source to be pinpoint in size, but design modifications have produced a source

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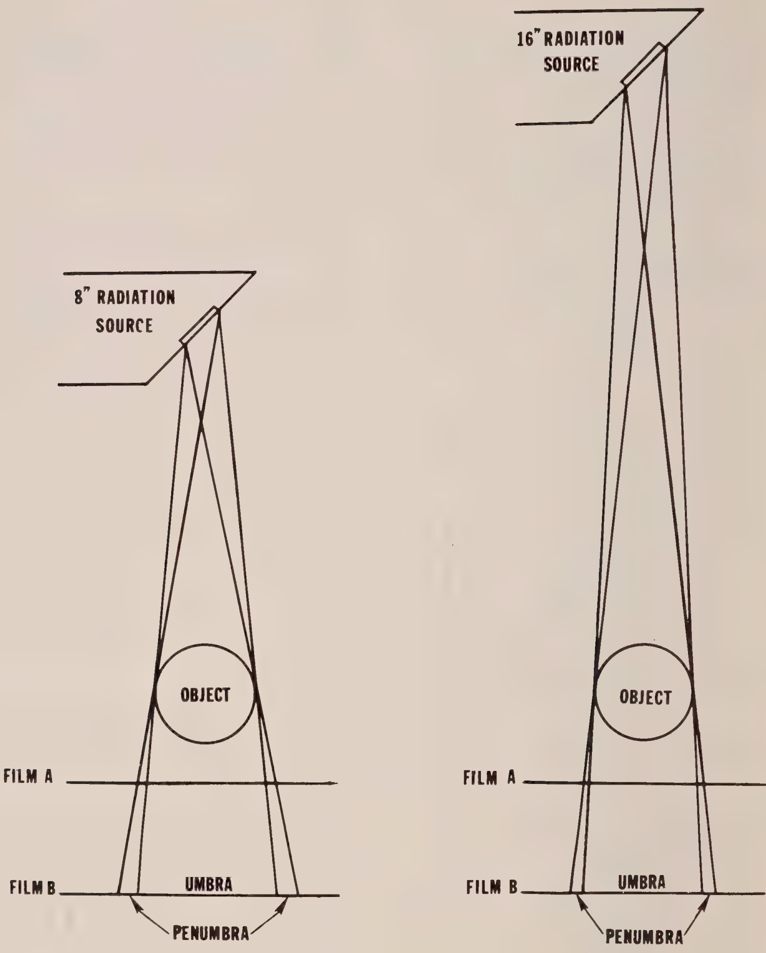

FIGURE 1

The umbra is the complete shadow cast by the object; the penumbra is the partial shadow cast and is the result of a source of radiation which emanates from a surface area greater than pinpoint size. The 16 inch radiation source is twice as far away from the object as the 8 inch radiation source. Film A represents a film placed close to the tooth and Film B is a film placed farther away from the tooth.

size which although small, does cover a small surface area. Consequently, the image cast by this source will produce a partial shadow or penumbra, the size of which has a direct bearing on the sharpness of the image. The smaller the penumbra, the sharper the image. (Figure 1) The size of the penumbra produced by your machine can be reduced by moving the source of radiation farther away from the patient, or by moving the film closer to the tooth. Since anatomic configurations govern the latter, the easiest way to improve the sharpness of the radiographic image is to use a long distance from the source of radiation to the patient.

Radiation like light travels in straight but divergent lines. In an x-ray beam the ray of photons traveling in the center of the beam is called the central ray. All other rays of photons in the x-ray beam travel in straight but divergent lines from the central ray. The farther the beam travels the more spread there is to the beam of radiation. Since an x-ray beam is collimated to allow a certain spread of this bundle of radiation at the open end of the cone, the shorter the cone the more divergent are the rays of photons allowed to exit from the machine. (Figure 2) The more divergent the rays, the more magnification of the image. With an increase in magnification there is a loss of image sharpness. Thus to obtain maximum sharpness of the image, a long distance from the source of radiation to the patient is desired. This results in the use of less divergent rays in producing the radiographic image thus producing a sharper and less enlarged image.

In a similar manner the placement of the film also contributes to the sharpness of the image. (Figure 3) With any given source-object distance, the farther away the film is from the object, the greater the degree of magnification and loss of image sharpness. This can be reduced by using a longer object-source distance.

Figure 4 shows the changes that occur in magnification and sharpness with various changes in object-source and object-film distances.

The first three principles of shadow casting that are discussed above have mainly to do with the sharpness of the image produced. The other two principles bear on the size and shape of the image produced or on distortion produced in the image. The ideal situation is to have the film and tooth parallel to each other with the central ray directed at right angles to the film and tooth. (Figure 5)

If the film and tooth are parallel but the central ray is not directed at a right angle, then the image cast upon the film will be elongated and cast on a different area of the film. (Figure 6)

If the film and tooth are not parallel and the central ray is directed at right angles to the tooth, then the image will be elongated. Should the central ray be directed at right angles to the film, in such a situation, the image will be shorter than the preceding image. (Figure 7)

In intra-oral periapical radiography, the placement of the film is governed by the anatomic situation presented by each patient. If

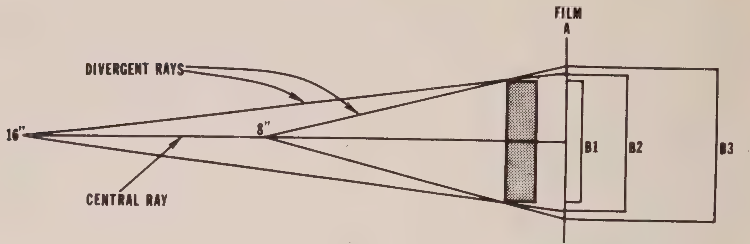

FIGURE 2

FIGURE 2. B1 represents the actual size of the object. B2 represents the size of the image produced by a radiation source which is 16 inches away from the object. B3 represents the size of the image produced by a radiation source which is 8 inches away from the object.

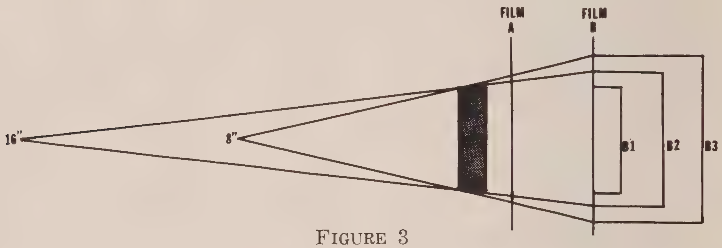

FIGURE 3

FIGURE 3. B1 represents the actual size of the object. B2 represents the size of the image produced by a radiation source which is 16 inches away from the object. B3 represents the size of the image produced by a radiation source which is 8 inches away from the object.

Film A shows these measurements when the film is placed close to the object; film B when the film is placed further away from the object.

FIGURE 4

FIGURE 4. The image on the left was produced by using an 8 inch object-source distance with an object-film distance as small as possible.

The center image was produced by using an 8 inch object-source distance but with a 1 inch object-film distance.

The image on the right was produced using the same 1 inch object-film distance but with a 16 inch object-source distance.

Note that the loss of image sharpness seen in the center image can be avoided to a large degree by using a longer object-source distance.

we attempt to place the film as close to the tooth as possible, then, with the possible exception of the mandibular molar film, the film will not be parallel to the mean plane of the long axis of the tooth. However, if we place the film parallel to the mean plane of the long axis of the tooth, with the possible exception again of the mandibular molar film, the film will not be in close proximity to the tooth.

This problem has resulted in the development of two basic technics of intra-oral periapical radiography. One where the film is placed as close to the tooth as anatomy will allow—the bisecting technic; and one where the film is placed parallel to the long axis of the tooth even though it may not be placed close to the tooth—the paralleling technic.

The bisecting technic is also known as the short cone technic although the use of a short cone has nothing to do with the technic itself. You can use the principle of the bisecting technic with any length cone. The principle is based upon a geometric theorum which states that two triangles are equal if they have two equal angles and a common side. In Figure 8 we see how this is applied to dental radiography. If we direct the central ray (AC) perpendicular to an imaginary line (BD) which bisects the angle formed by the mean plane of the tooth (BC) and film (AB) we set up a geometric situation which will allow us to project an image of the exact length of the tooth on the film.

A distortion free image only occurs in the image area produced by the central ray. Rays projecting an image in the areas other than that of the central ray, produce distortion since they are not striking the bisecting line at right angles. In practice the central ray is not directed at the apex because to do so would require an unnecessarily large beam area. Rather the central ray is directed at the center of the long axis of a tooth. This results then in distortion both apically and coronally. This distortion is also increased where the film is farther away from the tooth. In most instances then, the greatest distortion occurs at the apical portion of the film. This represents one of the major disadvantages of this technic.

A second major disadvantage is the superimposition of the malar bone upon the apical area of the maxillary molar teeth thus obscuring pathologic changes in this area. (Figures 9 and 10)

With such major disadvantages, you may wonder why this technic has such wide use in dental practices and up to recent years in our schools? Its major advantage is that it is adaptable to any anatomic variation found within the oral cavity. It also does not require the use of a film holding device and can be used with short exposure times and short cones.

Perhaps the latter is why it has had wide use simply because in the early days of dental radiography, the use of a short cone was necessary due to the slow speed of films available. Older practitioners can well remember when the exposure time for a maxillary molar film was 8 seconds. In order to use the paralleling technic, it is necessary to use at least a 16 inch object-source distance rather than

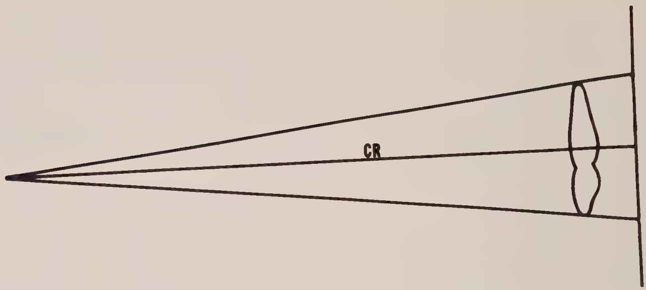

FIGURE 5
CR denotes the path of the central ray of x-ray photons.

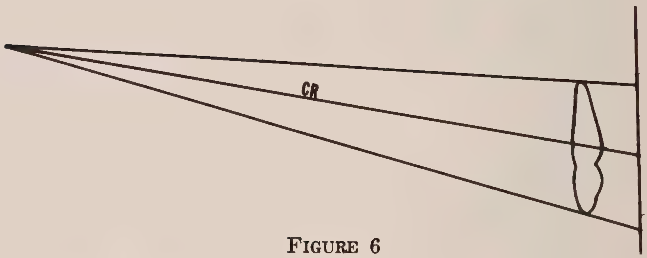

FIGURE 6
CR denotes the path of the central ray of x-ray photons.

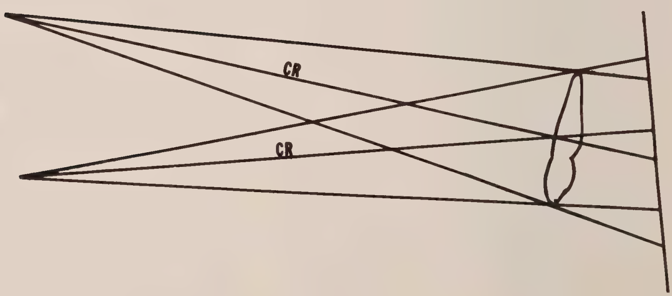

FIGURE 7
CR denotes the path of the central ray of x-ray photons.

the 8 inch distance used in the bisecting technic with a short cone. Since the intensity of a beam of radiation varies inversely with the squares of the distance, a doubling of the distance requires a four-fold increase in exposure time to produce the same film density. Thus instead of an 8 second exposure a 32 second exposure would have been required. Such a length of time is obviously not practical nor feasible with the dental x-ray machine. With the introduction and improvement in high speed films which require less exposure time, this advantage is no longer valid.

The paralleling technic is also known by a variety of names: long cone, right angle, extended cone, Fitzgerald, McCormick technic. In this technic the film is placed parallel to the mean plane of the long axis of the teeth and the central ray is directed at right angles to the film and teeth. To diminish the effects of an increased tooth-film distance, an increased source-film distance is used (16 inches or longer). Thus this technic fulfills more of the basic principles of shadow casting than the bisecting technic. (Figure 11) This results in less distortion which is uniform throughout the film and a much sharper image. The size and shape of the tooth are more accurately recorded on the film. Due to the angulation of the central ray, the superimposition of the malar bone upon the apices of the maxillary molars is avoided. (Figure 10)

Contrary to popular opinion, the paralleling technic also results in reduced radiation to the patient in spite of the increased exposure time. This is due to the fact that with a longer object-source distance, the useful primary beam contains less divergent radiation and thus does not radiate as much tissue as a shorter object-source distance. (Figure 12)

The disadvantages of the paralleling technic frequently cited are not valid. Some state that it is not useful in all areas and on all patients. With certain modifications it is useful although strict adherence to paralleling principles is not possible. The use of long exposure times or holding devices do not constitute valid disadvantages in this writer's opinion.

With such background information it is apparent that the paralleling technic is superior and will produce better radiographic results with somewhat less radiation to your patient provided one becomes as proficient in its use as with present technics. A professional man has no right to be other than proficient in any technic.

Should you fight or switch. You should switch.

How can you make the transition in your office without creating a nightmare of poor films and embarrassment. Very briefly do this: Make the changes in your equipment and technic (mas) and continue to use your bisecting technic but with a long cone. You will immediately notice a great improvement in the sharpness of your films. (Figure 13) Then gradually introduce yourself, your staff and your patients to the paralleling technic.

Now what changes do you have to make. First in equipment: The paralleling technic requires the use of a longer x-ray tube-film distance. This can be easily accom-

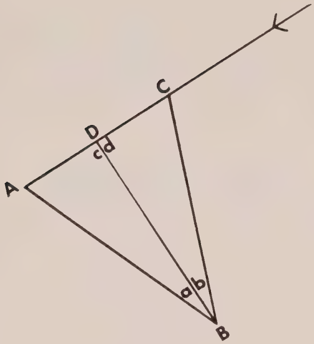

FIGURE 8

Triangle ABD equals triangle BCD because angle a = angle b, angle c = angle d and side BD is common to both triangles. Therefore, BC (length of tooth) = AB (length of image cast by tooth on film).

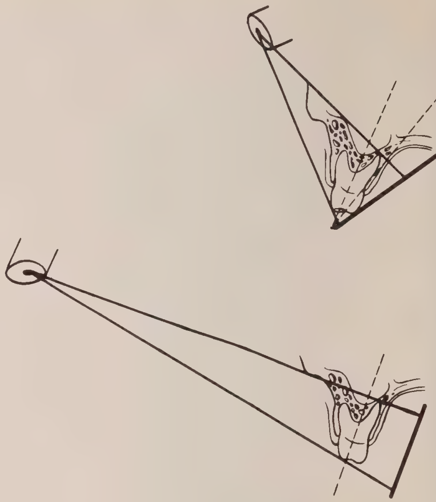

FIGURE 9

The upper drawing shows why the malar bone is superimposed on the apices of maxillary molar teeth when using the bisecting technic. The lower drawing shows how the paralleling technic avoids this problem. See figure 10 for actual appearance of each film.

FIGURE 10

The film on the top was taken using the bisecting technic. Note the obliteration of the apices by the malar shadow. The film on the bottom was taken using the paralleling technic. Note the clear view of the apical areas.

Basic Principles	Bisecting	Paralleling
1. Small Source of Radiation	SAME FOR BOTH	
2. Long Object-Source Distance	NO	YES
3. Short Object-Film Distance	YES	NO
4. Object and Film Parallel	NO	YES
5. Central Ray Directed at Right Angles to Object and Film	NO	YES
Total Number of Principles Fulfilled:	1	3

FIGURE 11

plished by purchasing an extension cone for your machine. Make sure that you include a proper sized collimating device for the increased distance. A lead lined cone is preferred and the use of a closed pointed cone in any length is contraindicated. (Figure 14) When x-rays pass through a substance one of the reactions which occurs is the production of radiation by the substance itself which adds to the radiation dose. This radiation is known as secondary radiation and serves no useful diagnostic purpose but rather adds to patient and operator radiation as well as increasing film fog. Therefore, the continued use of a closed pointer cone which produces secondary radiation is not in the best interest of the patient or of radiographic quality. You may find the use of the open end cone awkward at first but that is no reason not to employ its use. With an increased length and weight of the cone, it may be necessary to adjust the tension on the head and arms to avoid drifting.

If you are contemplating the purchase of new equipment, you may want to consider the modification of the x-ray head design as suggested by A. G. Richards which recesses the tube and allows for an increased tube-film distance without any significant external cone length distance. (Figure 15) This equipment is offered by one manufacturer now and will soon be by another.

You will also have to purchase and use some sort of film holding device with or without guides for cone placement and alignment. There are several such devices available ranging from a hemostat and stopper to an elaborate mechanism for film placement, tube position and alignment, with additional collimation of the primary beam.

The use of high speed film (Speed range D) is recommended for general use in any technic. The objection to high speed film based upon the grain size is no longer valid. High speed film significantly reduces radiation dosages and should be used in any technic.

Although you can utilize one size of film for all exposures (Type 1.2-adult posterior periapical) you will probably find it more convenient to utilize the narrower periapical film (Type 1.1) for anterior exposures. The narrower size facilitates film placement in many individuals. This may require the use of 5 maxillary anterior and perhaps 3-4 mandibular anterior films as well as the regular posterior films for a full mouth survey. (Figure 16)

As for technical factors you may use the same kilovoltage peak (KVP) as you now do. Thus you do not have to change the contrast which you prefer on your films. However, the exposure value does have to be increased. The formula for computing the exposure time is:

$$\frac{T^o}{T^n} = \left(\frac{D^o}{D^n}\right)^2$$

Where: T^o is Old Time
T^n is New Time
D^o is Old Distance
D^n is New Distance

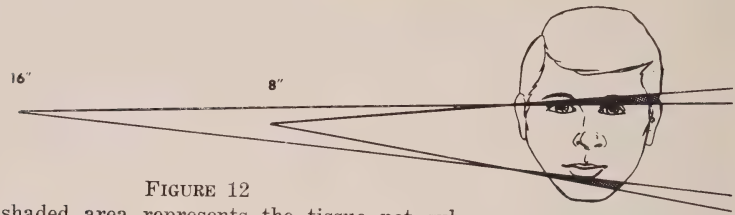

FIGURE 12
The shaded area represents the tissue not subjected to primary radiation when using a 16″ object-source distance rather than an 8″ object-source distance.

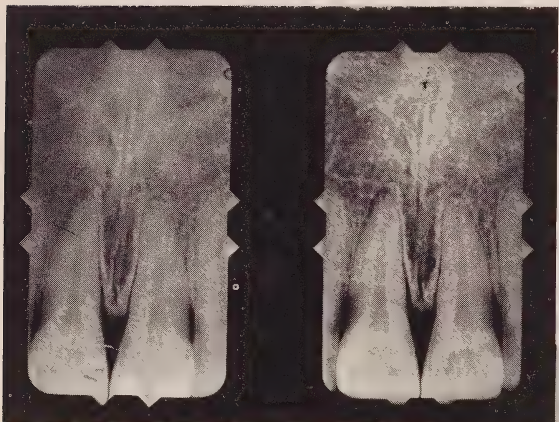

FIGURE 13
Both films were taken using the bisecting technic. The one on the left using an 8″ object-source distance and the one on the right using a 16″ object-source distance. Note the improvement in image sharpness and detail on the right film.

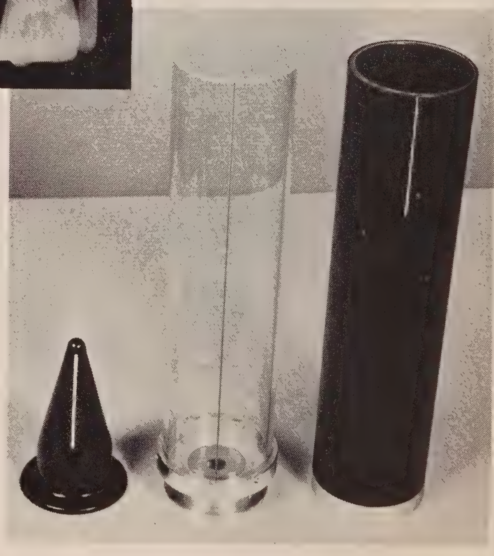

FIGURE 14
The pointed cone on the left produces unnecessary amounts of secondary radiation. The cone on the right is lead lined and preferred. Either the center or right cone is necessary to produce a longer object-source distance required for the paralleling technic.

For example, if you now use 1.0 second with 8″ distance at 65 KVP and 10 ma:

$$\frac{1}{X} = \left(\frac{8}{16}\right)^2; \quad \frac{1}{X} = \frac{1}{4};$$

$$X = 4 \text{ sec. at } 16''$$
$$\text{with } 65 \text{ KVP} + 10 \text{ ma}$$

If that time is too high for practical purposes, such as patient movement it can be reduced by increasing the milliamperage (ma). The ma multiplied by the exposure time equals the amount of radiation being produced (mas) at any given KVP. Therefore, 4 sec. at 10 ma = 40 mas; 2.6 sec. at 15 ma = 40 mas (approximately).

The exposure time can also be reduced by increasing the KVP. With an increase of 15 KVP, the exposure time is reduced 50%. Thus:

2.6 sec. = 15 ma at 65 KVP

1.3 sec. = 15 ma at 80 KVP

In making this change in KVP, you should take some test films as different machines may vary in their outputs at different KVP's. If you change the KVP, you will also change the contrast — the higher the KVP, the less contrast but longer scales of gray.

Remember that the radiation dose required to expose a film to proper density is basically a function of the film speed and not a function of the exposure time, ma or KVP although an increase in KVP does slightly reduce the total radiation dose. Therefore, the use of increased exposure factors in the paralleling technic does not increase patient dosage but to the contrary with proper collimation reduces patient exposure.

Having completed these changes in equipment continue to employ your present technic but with an extended cone. Begin to familiarize yourself with the technic of using the film holder, film and cone placement by practicing placement on your assistant and if your assistant takes radiographs have her practice on you. Anyone in your office who exposes radiographs should become thoroughly familiar with the technic before using it on patients. There will be some fumbling and awkwardness at first, and this is best resolved within your staff.

Introduce the paralleling technic gradually into your practice. You may find that the anterior exposures are easier for you. If so, start using the technic for those exposures and gradually use it on posterior views as well. Be patient—you may have 20 years or more of old habits to change.

No matter what you do, whether you switch or fight — do this — change to the use of a long, open ended cone and high speed film. If you do that much, you will get better quality films than ever before and reduce the radiation dose to your patients. If you switch to the paralleling technic, you will further improve the quality of your radiographs thus giving you more diagnostic information which should enable you to serve your patients more effectively.

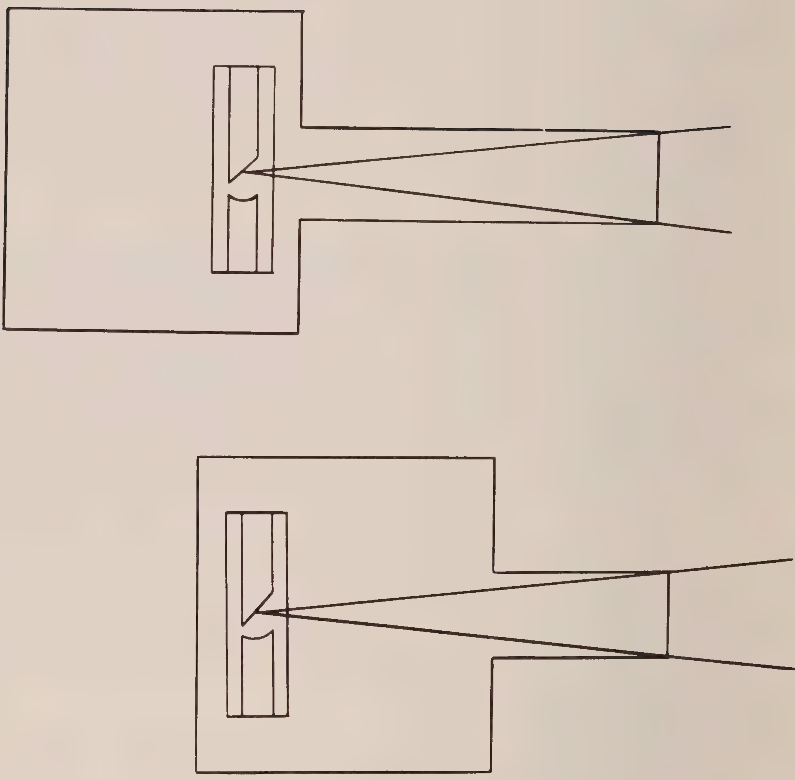

FIGURE 15
By recessing the tube in the head of the machine a long object-source distance is created without the need for an extension cone.

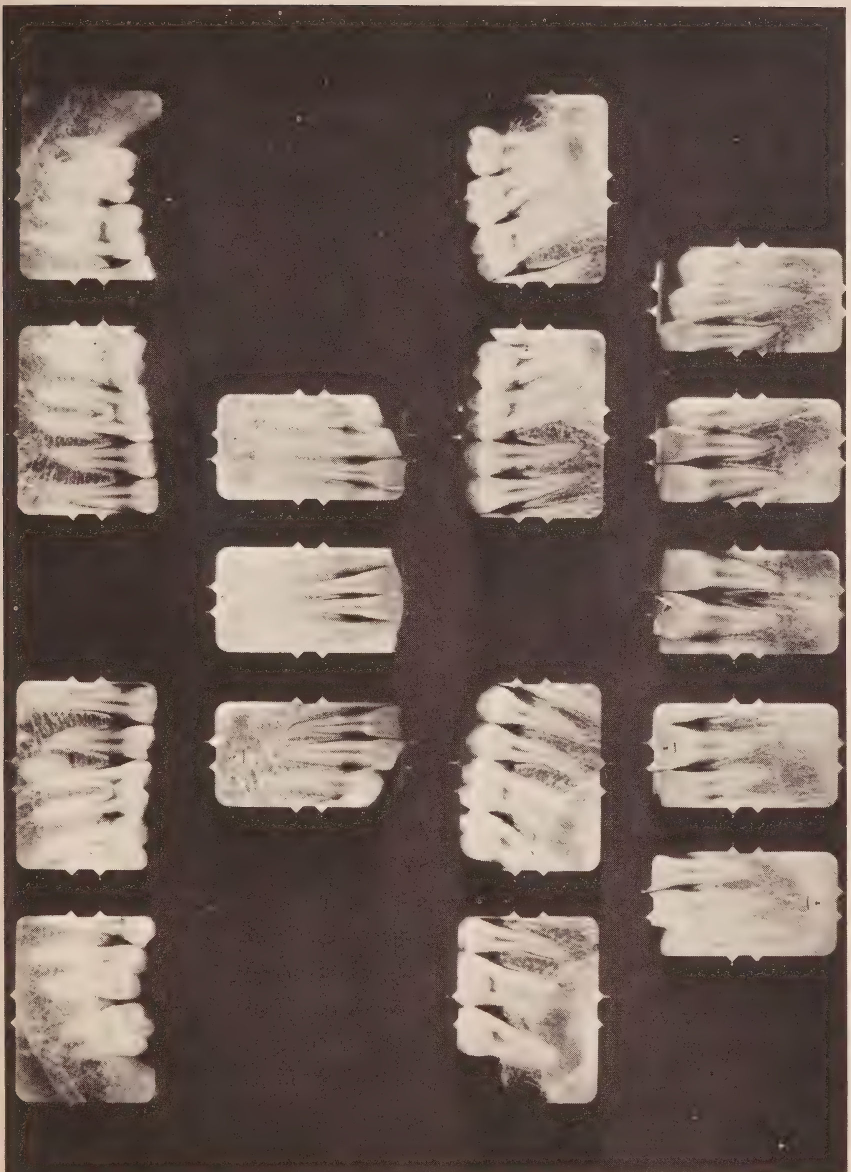

Figure 16

Example of a 16 film periapical series utilizing the paralleling technic. Bite wing films should be added as needed.

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Women's Prisons—Available Populations For Dental Research

Part I. The Female Correctional Institution and Its Residents

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Summary:

This article presents a brief description of a female correctional institution to provide the dental investigator with a summary of the appearance and operation of such an institution. It is the object of this report simply to provide an overview of the population and environment being suggested for pilot or exploratory epidemiologic studies. Part II of this report will document the oral findings of such a population to demonstrate the similarity of the group with the general population in regard to oral health findings.

Discussion:

Dental researchers are constantly seeking closed populations in which well planned studies may be conducted with adequate control of participants. This problem is of growing concern with the advent of the newly revived interest in the initiation of epidemiologic surveys. Epidemiology is defined as a science that deals with the incidence, distribution, and control of disease in a population, or the sum of factors controlling the presence or absence of a disease or pathogen. In planning an epidemiologic study, the modern investigator is benefited by the increased sophistication of the biostatistician. By statistical technique, we are able to utilize smaller samples from the target population to construct hypotheses related to the population being investigated. Considering this benefit, before initiation of large scale cohort longitudinal studies, one might reflect favorably on the potential of fostering a pilot study involving a closed type population to evaluate the administration and mechanics of a proposed epidemiologic project. In anticipation of locating such a population, attention was directed toward the involvement of female prison inmates, since such a group would be unique in having relatively similar living habits and being confined within a "well defined area." In most instances, it could be anticipated that regimentation, as demonstrated in a prison environment, would be conducive to reporting, examination, and fairly adequate similarity of daily habits. In cohort longitudinal studies, the bias of self selection for emigration and immigration of subjects is well accounted for, as individuals will perform movement in either direction as determined by legal procedures. Although it is the intention of this

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article to present the possibility of a potential source for future epidemiologic studies, it is important that the dental investigator be acquainted with some generalities associated with female prisoners and their place of confinement.

These investigators are presently involved in evaluating the potential for future oral epidemiologic studies to be conducted at the Maryland Correctional Institution for Women located in Jessup. It should be emphasized that Maryland can be considered as representative of other states in the administration and mechanics of other female prison institutions.[1] Maryland has only one prison for females and five prisons for males. The prison capacity for this women's institution is approximately 220 inmates, whereas the men's prisons have a combined capacity of approximately 4500 inmates. This situation is similar in every other state; that is, only one available institution for the incarceration of female offenders. The capabilities within the institutions for each may vary slightly, both for males and females.

The difference in the numbers of males to females incarcerated may be accounted for by the roles society has traditionally assigned to women. The homemaker, provided for and protected by men, has been the cornerstone of the family. Courts have been lenient and reluctant to sentence women, especially when dependent children are involved. She may be released with a warning, placed on probation, fined, but only sentenced to serve a term in jail when there seems to be no alternative. Though this concept may change as women seek greater freedom, the divorce rates climb and they become involved in different kinds of offenses.

Since there are fewer females incarcerated than males, we might consider some of the different types of offenses committed by women. Shapiro,[2] et al, have noted that there is a recent trend in offenses toward assault and shoplifting charges with indications of narcotics implicated offenses, that is, offenses committed in order to obtain narcotics directly or to obtain money to purchase narcotics. They also point out that over the past several years the number of narcotic-specific violations has vastly increased. The aforementioned investigators have also reported a statistically significant reduction in the mean age of female prison inmates in the Maryland Institution from 31 years to 26 years of age over a four year span (prior to July 1969).

Not only is there a significant difference in the number of females incarcerated, as compared to men, but there is also a marked difference in the type of institutions used to house male and female prisoners. Most men's prisons are large, fortress type stone buildings with cell blocks, iron bars, tiers, walls, guards with weapons and maximum security measures stressed throughout. Women's institutions are quite different. Security is at a minimum. The campuses are built on a "cottage system" with several small buildings housing approximately 30-60 inmates each. There are various types of men's institutions within each state to house different types of offenders. For instance, maximum security prisoners are housed in one institution, medium secu-

rity prisoners in another, and minimum security prisoners elsewhere. This is not true in the case of women, either in Maryland or elsewhere. The Maryland Correctional Institution, representative of other female institutions, houses all women 16 years or older, who are sentenced from 3 months to life imprisonment, within one institution. There is no difference in the degree of security administered or the type of housing involved.

Ideally, the first and foremost purpose of an institution is to detain prisoners. Secondly, it is the hope of the administration to return any resident to society a better adjusted, better educated, and more law abiding citizen than she was at the time of her arrival into prison.

As mentioned previously, the Maryland Correctional Institution for Women is administered on the cottage plan. The main campus consists of an administration building, four cottages housing from 30-60 women each, an auditorium, chapel building, a power house, and a building having a central kitchen and dining area. There are abundant athletic recreational facilities. Again, it is a minimum security institution.

When new residents arrive at the institution from the courts, they are confined in the admitting cottage, where they are placed in quarantine for one week. During this time, they are given a physical examination, interviewed by classification counselors, who take a complete social history of each resident, and they are observed by the cottage officers so that any peculiarities, problems or difficulties can be noted. During this time, they also attend an orientation session consisting of a discussion of the rules and regulations of the institution. When residents are released from quarantine, they are brought before the Classification Team for evaluation and assignment to living quarters and program.

This Classification Team is deemed the most important factor in preparing and returning a resident back to the community. The team is composed of the Assistant Superintendent as Chairman, the Classification Supervisor, the resident's Classification Counselor, the Institutional Psychologist and the Senior Custodial Officer. Each resident appears periodically before the Classification Team for an evaluation and recommendation concerning her job, cottage, school and group therapy.

Job assignments in the institution include working in the sewing shop, where the women learn to operate commercial type sewing machines so they are qualified to take employment in industrial firms following their release from the institution. There are also jobs available in the central kitchen and dining room, clerk-typist positions in the educational department, hospital aide positions in the institution's small infirmary, laundry positions, beauty shop positions and janitress and volunteer work assignments as well as maintenance crew assignments for those who are interested in the domestic and outside grounds work that must be done in every institution.

Institution programs include compulsory academic education for residents with fifth grade achievements or less. Intermediate and

secondary classes which include high school equivalency achievement are voluntary.

While in the institution residents may earn 5 days per month off their total sentence for good behavior beginning the month following their admission. They may also earn 5 days a month off their sentence for working and attending school classes. Monetary incentives are offered ranging from 40¢ a day to $1.00 in the more skilled positions such as a machine operator in the State Use Sewing Shop.

The Medical Staff consists of a small infirmary staffed by two registered nurses with the assistance of two resident hospital attendants. A physician, employed on a part-time basis conducts sick call twice a week, and there is a dentist employed on a part-time basis. There are several consulting medical specialists on the staff, all of whom are available for specialized medical problems. When a pregnant woman is admitted to the institution, she is registered in the out-patient clinic at the University Hospital in Baltimore and receives regular checkups in that clinic as any other patient until the date of delivery. She is admitted to University Hospital for the delivery and returned to the institution approximately three days after the baby is born, if there are no complications. She is followed in the out-patient clinic until her final six week checkup. The baby remains in the University Hospital nursery until the institution arranges for placement either with the mother's family or with the Welfare agency for temporary foster home placement. There is a psychologist on the staff who conducts behavioral group therapy sessions and narcotic group therapy. A consulting psychiatrist visits the institution twice a month and meets with individuals requesting to discuss problems with him. Others are referred to the psychiatrist by the staff. Needless to say, his appointment list is extensive, and the scheduling for an appointment involves a considerable length of time.

Residents of the institution live and function on the grade system. If a resident is in Grade #1, she lives in the Honor Cottage, which affords her special privileges such as being permitted to have food brought in to her. She may have her visits in the cottage recreation room, make two telephone calls home a week and have no restrictions on how long she may stay up or keep lights on. A resident on Grade #2 has regular visiting privileges, recreation privileges, may make one call home a week and must abide by the lights out rules and hours for residents to be in their rooms. On Grade #3 a resident has no recreation privileges but goes to the dining room for meals, to her job assignment and visits. Grade #4 calls for confinement in her room or in the detention area of Horigan Cottage if behavior necessitates it. On Grade #4, a resident has no privileges and can also lose good behavior credits earned off her total sentence while in the institution.

The institution features a Resident Community Council consisting of a President, Vice President, and Executive Secretary and 3 representatives from each of the 4 cottages. The Council is elected by the prison population every six

months. The purpose of the Council is to develop better communication between residents and staff, to work with the Administration in the development of resident programs and activities, to work toward the betterment of the general welfare of the resident population and to help develop a program of social living within a correctional setting. In conjunction with this effort, the Superintendent meets with the total population quarterly or whenever deemed necessary for the purpose of discussing current and tentative programs and policies. The Superintendent holds "Open House" once a week when he conducts interviews with any residents who wish to discuss problems with him.

There are a number of volunteer participation programs available in the institution which complement the rest of the curriculum and participation in them is greatly encouraged. For instance, several Narcotic Group Therapy Programs are being conducted in the institution. Two programs are being conducted by custodial personnel; one by a consulting psychiatrist, and the other by the institution psychologist, who is also conducting a behavioral group. A chapter of Alcoholics Anonymous is active in the institution and meets once a week with outside community groups participating in the guidance of the program. In connection with the same program, the Howard County Division of the Baltimore Area Council on Alcoholism sponsors a weekly meeting at the institution.

A Planned Parenthood course is administered continuously throughout the year. It consists of discussions conducted by prominent physicians and psychiatrists, under the sponsorship of the Planned Parenthood Organization. A social Awareness Discussion Group is conducted by members of the Council of Churches on a continuous basis. This group places emphasis on a discussion of social problems of society.

A new clerk/typist keypunch operator program was initiated in the institution in January, 1970, and 38 residents have been accepted to participate. This program provides eight weeks of ½ day sessions, 5 days a week, during which time the participants take intensive training in the skills of manual typing, electric typewriter and keypunch operation. Upon completion of this course, they should be qualified to pass both Federal and State Examinations to procure employment.

A work release program is in operation, which allows those qualified and carefully selected to work for regular employers in the community outside the institution. These people are allowed to leave the institution to go to their places of employment and return to the institution at the conclusion of their work day.

There are three legal methods by which residents may be released from the institution. They may be released by the court within 90 days after admission, providing the sentencing judge feels they deserve this consideration; secondly, they may be paroled; or, thirdly, by termination of sentences.

Thus, in brief form, we have presented a description of the female correctional institution to provide the dental investigator with a sum-

mary of the appearance and operation of such an institution.

It is the object of this report to simply provide an overview of the population and their environment, being suggested for pilot or exploratory oral epidemiologic studies. Part II of this report will document the oral findings of such a population to demonstrate the similarity of the group with the general population, in regard to oral health findings.

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Women's Prisons—Available Populations For Dental Research

Part II. The Oral Findings of Female Inmates

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Summary

The objective of this presentation is to demonstrate that the dental findings of the residents of female correctional institutions are compatible with the dental findings of a non-institutionalized population. The results of the study suggest that this population source for dental research is valid. It is the recommendation of the investigators that the dental profession establish the same rapport with correctional agencies as the medical profession, and thus make available for pilot research projects the residents of the institutions.

Introduction

It has been suggested that women's correctional institutions could indeed provide an acceptable population for pilot studies in the various disciplines of dental research. The purpose of the presentation is to present the oral findings of female residents of one such correctional institution. To satisfy the demands of clinical research protocols, the investigator must demonstrate that he has successfully identified a well defined sample population in which the disease patterns are representative of the total population. The following information will demonstrate the reliability of the dental findings of the residents of Maryland Correctional Institution for Women, when compared with the general non-institutionalized population. The mean age of the population of the United States has steadily decreased until we are now approaching the establishment of a population with a mean age distribution well centered in the second decade of chronological age. Shapiro, et al,[1] have demonstrated that there is a simultaneous effect being exerted on the age distribution among female offenders who are incarcerated. In a descriptive study of trends in age distribution, they have demonstrated that the mean age of female offenders has decreased from 31 years of age to 26 years of age, which, in essence, brings the ages of the institutionalized population well in line with that of the existing non-institutionalized population.

Materials and Methods

Dental examinations were completed on all the inmates in residence from October 1, 1969 until December 31, 1969. 157 examinations were completed in detail. The examinations were conducted in the dispensary of the institution and scheduled by the dispensary nurses. It is interesting to note at this time that all recording of dental data was accomplished with the cooperation of two inmates who had been employed as dental assistants for several years before becoming involved in activities resulting in their incarceration. These young women were thoroughly trained in dental recording

activities, and proved to perform most effectively and efficiently during the study. The dental findings of the subjects were recorded on a standard dental field survey record form (designed by the Biometry and Field Investigations Branch of the National Institute of Dental Research). The form provides the capability of recording the DMFS (Decayed, Missing and Filled Surfaces) for individual teeth, as well as the Periodontal Index (Russell)[2,3] and Oral Hygiene Index-Simplified (Greene and Vermillion)[4] for individual teeth. The form is designed for interpretation and analysis by optical scanning equipment. This report will, however, present only the DMFT (Decayed, Missing, Filled Teeth) findings.

The actual examination was conducted with the use of mirror, explorer, and adequate illumination. Radiographs were not used. The characteristics of dental disease can be estimated from a DMFT survey, as indicated by Knutson;[5] however, the basic data in this study was recorded as a DMFS survey from which DMFT for each tooth was noted. The examination was performed to determine the status of 28 teeth, the third molars not being included since no radiographs were taken. The difficulty that would confront the investigators in determining accurate classification for any missing third molar teeth was eliminated. Description for use of the Survey Form will not be detailed at this time, as such information is available from the Dental Clinical Trials Data Processing Manual of the Biometry Section of the National Institute of Dental Research.

Following the same protocol as illustrated by the Field Investigation Branch of the NIDR, no carious lesion was diagnosed unless it was demonstrable beyond the possibility of a doubt. A deep pit or fissure was not recorded as carious unless there was more than a catch of the explorer pressure and visual evidence of deterioration of the pit or fissure wall. The deep pits or fissures per se were not considered carious. There had to be an obvious break of surface continuity for the tooth to be considered carious. The examination included a complete DMFS, a Periodontal Index, (Russell), and an OHI-S measurement as described by Greene and Vermillion.

Results

Examinations were completed on 157 subjects, comprising the entire institutionalized population. DMFT counts in the presentation are based on 28 teeth, and do not include third molars.

The mean age distribution for the 157 residents was 28.54 years of age, with 59 subjects between ages 16-30 years, comprising 44% of the total population. The non-white to white ratio distribution was approximately 2.5 to 1 respectively.

Table 1 demonstrates the mean total number of decayed, missing and filled teeth of the subjects by age groups. As the age groups advance in age, we can observe a rise in mean total DMFT for the 16-20 years of age group of 12.27, to 25.00 and 28.00 teeth for the age groups 56-60 and 61 and over, respectively. There is a steady rise in mean DMF teeth, with the exception of the age group 46-50 years, which is an artifact in this graph simply because of the small number of subjects in this age

TABLE-1. MEAN NUMBER OF DECAYED, MISSING, & FILLED TEETH BY AGE GROUPS.

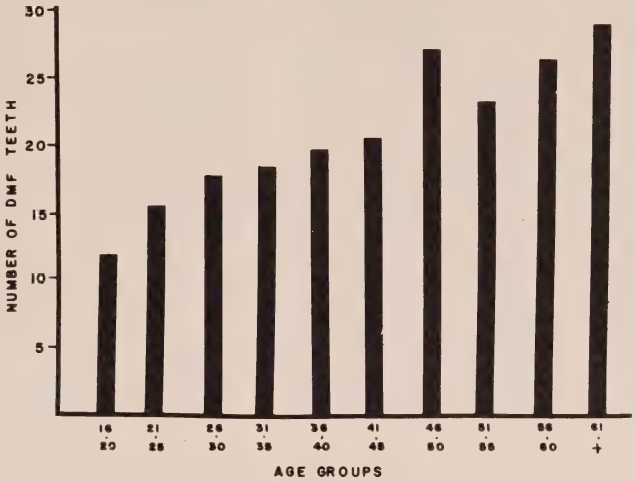
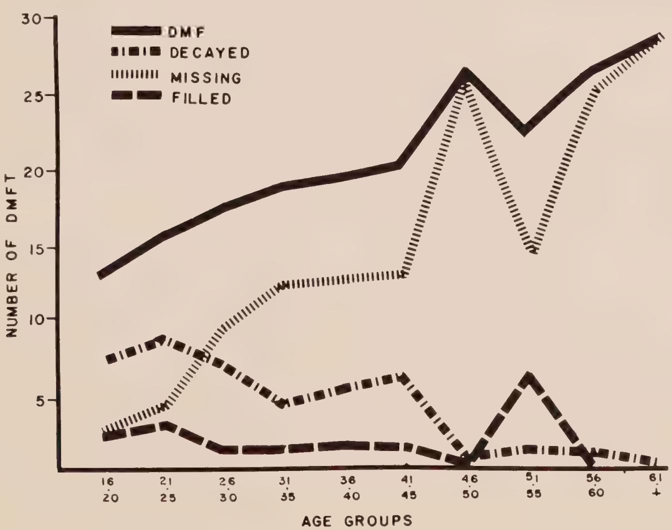


TABLE-2. MEAN DMFT & DECAYED, MISSING, & FILLED TOOTH COMPONENTS BY AGE GROUPS.



group. The numerical data contributing to the determination of the DMFT for each age group is presented in table 3. From this data, we can observe the steady state occurrence of the interrelation dynamics of the factors comprising the mean total DMFT. Decayed, missing and filled teeth followed consistent trends in their individual contribution to the total DMF scores. The entire population showed abundant evidence of prior attack by dental disease. All age groups showed entries into the three components of the total DMFT, with the exception of the older age groups, that is, 56 years and older, which demonstrated increased emphasis on the missing tooth factor, frequently to the full 28 tooth complement.

The relationship of each of the components of the total DMFT is reflected in Table 2. It is evident that the missing component plays an increasing rôle as age progresses, whereas the decayed and filled portions decline steadily as the age intervals increase in chronological order.

However, it is noteworthy to emphasize that, although Table 2 demonstrates the gradual decline in the filled factor of the DMFT as age increased, Table 4 shows that, if we examine the entire concept of treatment rendered by establishing a filled to decayed-missing-filled tooth ratio (F/DMF ratio), the curve shows tendencies of skewing to the left when the population is examined as a cohort from time of birth. This finding is also evident in Table 2 with slight positive skewing to the right, but less readily evident until presented in Table 4, when the F/DMF percent is plotted against birth date. This is illustrative of the change in care being rendered to the younger age groups and perhaps the impact of dental health education reaching young people, even though the highest rate is a dismal 19% for the 16-20 age group. The only exception being the 51-55 age group with a slightly higher rate that is attributable to the small number of subjects in that age group. In Table 4, this situation is illustrated by an anticipated trend as indicated by a broken line extending from birth date 1910-14 to 1920-24.

Table 5 illustrates the number and percentages of DMFT per person. Once again, the entire range of DMFT rates is distributed for the 28 teeth. When a percentage of total DMFT per person is examined, there is no marked accumulation at any of the DMFT rates. There is a slight rise at DMFT of 15 to 18, but over all, the variation between the total rates does not vary more than 7% from the lowest to the highest total rate.

As expected, the mean number of sound teeth decreases with age; the mean number of sound teeth being 16.51 at ages 16-20 and declining to a mean number of sound teeth below 2.00 at ages 56 years and above, as evidenced in Table 6.

Discussion

The trends in the appearance of dental disease among the female residents of the Maryland Correctional Institution for Women are consistent with findings presented in the National Health Survey for the years 1960-62.[6,7,8] The National Survey was aimed at the non-institutionalized civilian U. S. population. The study documented in this report demonstrates the re-

liability of the dental findings of the institutionalized population, and the techniques for examination procedures are validated by the close association between these findings and the findings of the National Survey.

Estimates from the National Survey revealed a clustering of DMFT rates at approximately 17 DMFT per person, based on examination of 6,672 persons. As mentioned previously, there was a similar clustering of DMFT per person in this study between 15 and 18 DMFT per person, with the highest rate being at 17 DMFT per person.

DMF teeth accumulated with each age group from 12.27 at age 16-20, to 28.00 at ages 61 and older. There was a successive increase at each age interval, an effect similarly presented in the national figures. A simultaneous decrease in the decayed portion of the total DMFT rate occurred with advancing age; a similar effect was observed with the filled tooth factor. Therefore, it is readily observed that the rise in the DMFT as age progresses, is primarily due to the missing tooth component, which steadily increases with age, from a low mean per person of 2.27 teeth at ages 16-20, to a high of 26.5 in age groups 56 and older.

The objective of this presentation is to demonstrate that the dental findings of the residents of female correctional institutions are compatible with the dental findings of a non-institutionalized population. The results of the study suggest that this population source for dental research is valid. It is the recommendation of the investigators that the dental profession establish the same rapport with correctional agencies as the medical profession, and thus make available for pilot research projects the residents of the institutions.

Table 3. Mean Number of Decayed, Missing, and Filled Teeth by Age Groups

Age Intervals	*Number of Subjects*	*Decayed*	*Missing*	*Filled*	*DMFT*
16-20	33	7.03	2.27	2.18	12.27
21-25	42	8.50	3.95	2.98	15.43
26-30	31	7.37	8.90	1.20	17.47
31-35	18	4.50	12.39	1.56	18.44
36-40	13	5.69	12.39	1.15	19.08
41-45	10	5.80	13.00	0.90	19.70
46-50	4	0.50	26.25	2.00	26.75
51-55	3	1.33	14.67	6.67	22.67
56-60	1	1.00	25.00	0.00	26.00
61 +	2	0.00	28.00	0.00	28.00

TABLE-4, RATIO OF FILLED TEETH TO DMF TEETH

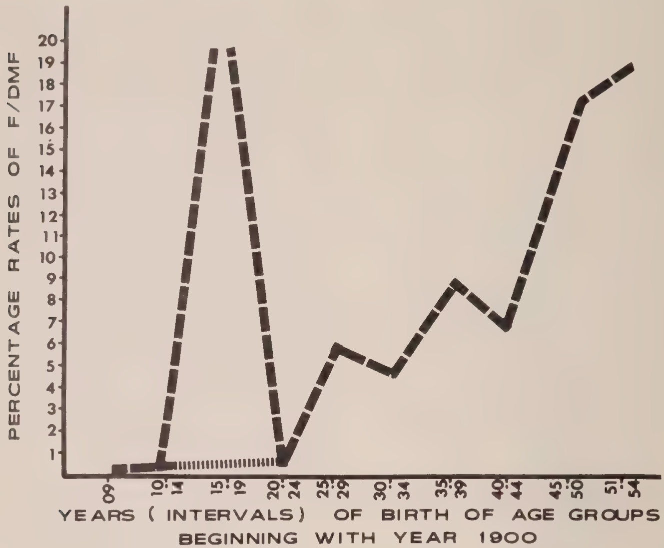


Table 5. Number of Decayed, Missing and Filled Teeth by Number of Persons and Percent of Total

DMF Teeth	*Number of Persons*	*Percent of Total*	*DMF Teeth*	*Number of Persons*	*Percent of Total*
1	3	1.9	15	10	6.4
2	0	0.0	16	8	5.1
3	1	0.6	17	14	8.8
4	0	0.0	18	9	5.7
5	2	1.3	19	5	3.2
6	3	1.9	20	5	3.2
7	6	3.8	21	9	5.7
8	3	1.9	22	7	4.5
9	6	3.8	23	5	3.2
10	6	3.8	24	5	3.2
11	4	2.6	25	3	1.9
12	10	6.4	26	4	2.6
13	7	4.5	27	3	1.9
14	8	5.1	28	11	7.0

Table 6. Mean Number of Sound Teeth by Age

Age Interval	*Number of Persons*	*Mean Number of Sound Teeth*
16-20	33	16.51
21-25	42	12.62
26-30	31	10.53
31-35	18	9.00
36-40	13	8.92
41-45	10	8.30
46-50	4	1.25
51-55	3	5.33
56-60	1	2.00
61 +	2	0.00

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Format Recommendations For Contributors

I. General Information

Two complete manuscripts with illustrations should be sent to the Editor, Journal, Baltimore College of Dental Surgery, University of Maryland School of Dentistry, Baltimore, Maryland 21201. The articles which are submitted for publication are expected to follow the format suggested below. It is assumed that the papers are based on original data and that they have not been published or previously submitted for publication in other Journals.

II. Text Sections

Each article should be sequentially arranged as follows:

A. Summary
B. Introduction
C. Materials and Methods
D. Results
E. Discussion
F. Acknowledgements
G. References

III. Text References

References cited in the text should include the author(s) last name and publication year as in "Doe and Brown (1966)". Multiple authorship (more than 2) is initially cited *in toto.* e.g. Doe, Brown and White (1966). Subsequent reference to the multiple authorship (more than 2) should be made as: Doe, *et al.,* (1966).

IV. Bibliographic Reference

A. References cited bibliographically should be alphabetically and sequentially arranged as follows: author(s), year, article, title, Journal (Index Medicus preferred), volume and complete page coverage. Example:

Doe, J. J., Brown, D. M. and White, S. T. 1966. Fibrillogenesis in the dental sac. **The Journal** *21:* 55-63.

B. Author(s) having two or more publications in a given year should be designated as *a*, *b*, etc. Examples:

Doe, S. S. and Brown, D. M. 1966*a*. Heterochromatin in oral epithelial cells. **The Journal** *20:* 73-85.

——— 1966*b*. Cytochemical features of oral epithelium. **The Journal** *20:* 98-110.

C. Book or monograph citations are arranged as:

Doe, S. S. and Brown, D. M. 1966. Inheritance and Development (Edited by White, S. T.) Chapt. 1, p. 16. University Press, Baltimore.

D. References which are in press or are personal communications are given as follows:

Doe, J. J. 1966. Fibrillogenesis in the dental sac. **The Journal** (in press).

Brown, D. M. 1966. (personal communication).

V. Illustrations, Legends and Tables

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by

JOHN S. ZAPP, D.D.S.

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A View Of The Profession For The Graduating Dentist*

by

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Graduation from Dental School represents to you both an ending and a beginning. It marks the end of this phase of your formal dental education. It marks the beginning, for most of you, of your professional career. Some of you, doubtless, will continue in graduate work. For all of you it represents a milestone in your life, a high point in your climb to professionalism. It would seem appropriate to reflect for a few moments on the significance of this notable event.

For the past few years you have lived and worked in the cloistered walls of this fine institution of higher learning. You have enjoyed the tutelage of some of the ablest professional men in your chosen field. You have been led, directed, encouraged, guided and, perhaps at times, verbally chastised by your professors. You have learned the pathology of the oral cavity and its relationship to the overall health of the individual. You have learned the etiology and the cure for most dental diseases. You have mastered the *science* of dentistry and doubtless have acquired some proficiency in the *art* of dentistry.

*Presented at the Honors Convocation of the University of Maryland School of Dentistry, June 5, 1970.

You are now ready to learn the *practice* of dentistry. Many of you will now enter the marketplace to make available to the public your professional knowledge and skill. Learning the *practice* of dentistry you may find to be the hardest course in all your dental training. No longer will you have a professor to direct your activity and to consult with in the handling of each case. You will be on your own. The decisions are yours to make. When you lift the handpiece to work on your own first private patient, you may feel a little tremor of apprehension which you did not experience with your last patient in the dental clinic. At the same time you will experience a great thrill of achievement for at that moment you will indeed have become a dentist and on your way to being a true professional.

Being a dentist brings many rewards both direct and indirect. Not the least of these rewards is the opportunity to earn a good living. Doubtless this is one of your goals and no apology is needed. Almost everyone in every trade and profession aspires to earn an income that will sustain himself and his family at least at a comfortable level. With respect to this goal you enter the practice of dentistry at a particularly good time. There is a growing shortage of dentists and the time it takes to develop a new practice is far less than it once was. An important indirect reward is the satisfaction of rendering a health service that no one but a dentist is qualified to render. Not the least of the indirect rewards is the satisfaction of turning out a restoration, a crown, or a bridge of which you can be proud. Dentistry is an art as well as a science and you will no doubt experience the artistic satisfaction of viewing a job well done. When you have completed the restoration of a broken-down mouth you will derive a deep satisfaction from having restored a fellow human being to sound dental health. This satisfaction alone should give you continuing incentive to improve your technics and develop your skills. By the same token it should encourage you to avoid ever doing shoddy work through indifference or through a baser desire to speed up your work to increase your income or shorten your day, but at the expense of quality. Let me assure you that in the long run, shoddy work will destroy one's reputation in the community and will reduce rather than increase income. Peer review, in one form or another, increasingly is classifying the quality of a man's work even in private practice. The public is increasingly sophisticated with respect to what constitutes good dentistry.

The practice of dentistry, as I have said, brings many rewards to the dentist. At the same time it brings to the dentist heavy *responsibilities* with respect to the health of his patients. In this period in which you are entering dentistry you are, as a professional, faced also with a heavy social responsibility. We have reached a level in our social development in which health care for all people is no longer an individual privilege for those who can afford adequate care. Health care is considered a right that cannot be denied to any person regardless of their economic status. This concept is not new, but as our social conscience has developed and as we have become more affluent as

a nation we are advancing from theory to practice with respect to the concept of health care as a "right". The 1960's saw a great increase in the number and magnitude of public programs to bring health care to the people. The 1970's, I am confident, will see further development of such programs and will bring increasing "know-how" and sophistication in their operation.

The dental profession has a great responsibility and, in fact, a great personal stake in the development of public programs for the health care of the public, particularly those in the low income groups. Actually, the organized dental profession has been in the front ranks of those urging the development of such programs. To the lasting credit of our profession it was aware as far back as the 1930's of the terrible neglect of dental health among the low income and indigent groups. Furthermore, our profession did something about the problem. It publicized the problem, urging local schools and health departments to set up dental care programs for the needy. Our profession urged Congress in the early 1940's to take action to provide dental health care to those in need. It was largely through the efforts of our profession that the National Institute of Dental Research was established with a budget that has expanded with almost every year of its operation. I would impress upon you that when the American Dental Association has spoken on these issues it has not done so as an independent agency. It has spoken as the voice of the vast majority of the dentists of America. It has reflected the will, and I might add, the conscience of those who make up its membership. I assume most, if not all of you will take your place in the ranks of organized dentistry. I am equally sure you will lend your support to the programs your organization sponsors.

Your government, at both the State and National levels, *shares* with the profession in the concern for the health of our people. In saying this I want to underscore *your* government. It is not *the* government. It is *your* government in the same sense that the A.D.A. is *your* organization. The government is responsive to the needs of the people and to the desires and needs of your profession.

I said earlier that due to an increasing shortage of dentists you are entering practice at a most propitious time. While this situation redounds to your benefit, I must tell you that lurking back of this situation is a serious dental manpower shortage that has profound social implications. The very success of the efforts of the dental profession in its health education efforts has resulted in an increase in the demand for services that is straining the capacity of the profession to meet. The sharp increase in the population alone has added a heavy burden to the already heavy load. The growing programs for dental services for the underprivileged under government sponsorship are creating new demands for care from segments of the population who received little dental care in the past. All of these factors collectively conspire to create a dental manpower shortage that *cannot* be met within the framework of dental practice as it now exists on a national basis!

What is the answer to the dental

manpower problem? More dental schools and larger enrollments of dental students? Certainly this is needed, but *time* does not allow for this approach as a solution to the demands immediately ahead. To build a new dental school and graduate a first class, even if funds were available to do so, would require a minimum of from ten to fifteen years. The need is now! What, then, is the answer? The answer, I believe, lies in major innovations in the way in which dentistry is practiced. This view is shared by many in the leadership of the dental profession.

It has been clearly demonstrated and is becoming widely accepted among the dental profession that the productivity of the average existing dental office can be greatly expanded in a relatively short time by the widest use of dental hygienists and dental assistants consistent with safe and sound dental practice, also group and multidisciplinary group practices. Our profession has too long been obsessed with the archaic notion that the only proper function of an assistant is to seat the patient and arrange the dentist's instruments.

Time does not permit nor do you need to be told what you already know about the possible functions that an assistant can perform. What I do want to emphasize, however, is that talk and agreement are not enough. Now is the time for action. State dental practice acts must be changed at once. Training programs for assistants and for dentists in the utilization of assistants must be instituted immediately. Both the American Dental Association and the Federal Government are in agreement with respect to the need for such changes. Several States already have broadened their dental practice acts to accomplish, at least in part, these goals, to make both the hygienist and the dental assistants really effective as members of a dental team. As you know, such changes in dental practice acts do not just "happen". Rarely have they developed as an original act on the part of the State legislature. They develop because a far-sighted organized dental profession has taken the necessary action to bring the changes about. A word of warning! Unless the organized dental profession does originate such necessary actions, public pressure likely will result soon in such actions *originating* in the State legislatures. It would be far better both for the profession and the public if such unilateral action were made unnecessary through leadership and action by the profession.

Resistance to change, whether it be social change or change in the practice of dentistry *usually* comes from the middle aged and over. This is to be expected. First, man is a creature of *habit* and once habits become firmly established they become difficult to change. This is true whether it relates to minor personal or major social habits as they relate to our mode of living. As creatures of habit, often we find such change painful even if the change actually results in improvements in our conditions of living. Second, by the time we have reached middle age many in society, especially those in positions of leadership, have secured a place in the establishment which the individual finds advantageous. Change in the existing

order may appear to threaten or may indeed threaten the individual's position of advantage. Thus, it becomes almost a defensive reflex on the part of the so-called "establishment" whether it be in the total social complex or in the dental profession to resist change.

This may sound like an apologia for present day campus disturbances. In fact, it *is* related to the unrest on our campuses. I would underscore, however, that in no way am I suggesting that destructive campus outbursts are either *justifiable* or *constructive*. I do suggest, however, that society as a whole and universities in particular must recognize the basic realities of resistance to needed social change. Such a recognition is basic to the introduction of reforms in our social structure through a sound and orderly process. This observation has a direct bearing on our own dental profession and on the training provided in our dental schools. The changes in the practice of dentistry that I have described are being brought about by social forces beyond our control. They are being brought about by a skyrocketing demand for dental care with which our outmoded system of delivery of this vital health service is simply not equipped to cope. My plea, therefore, is that the "establishment" in the dental profession *accept* the need for change and lend its support and its know-how and experience to bring about needed change in an orderly and effective manner. It is my plea that the dental schools accept this same fact of life. I urge them immediately to re-examine their curricula and introduce such changes as are needed to prepare the dental student to practice the dentistry of tomorrow—not the dentistry of yesterday. I am addressing these remarks to dental schools generally. Especially, I am addressing my remarks to you, the graduating class of this year. As active practitioners I would hope all of you will both adapt to and adopt the newest methods of practice. As members of your dental society, I would hope you will bring your influence to bear with respect to these issues. As alumni, I would hope you will take an active and continuing role in helping to guide the future policies of your school.

Up to this point, I have limited my remarks to the problems of providing adequate dental care to the public. While these problems are of particular concern to us as dentists, as members of the total health profession, and as citizens, we must be concerned with the whole range of health problems our nation faces.

We spend more than $60 billion a year for health in the United States, yet tens of millions of Americans are not getting the care they need because they can't afford it.

We pride ourselves in having the finest biomedical research establishment in the world, yet we are tragically *inept* at turning research knowledge into improved health care, both dental and medical.

We operate more than a hundred schools of medicine and osteopathy and 50 schools of dentistry, yet we do not have enough doctors to care for the sick and keep the healthy well.

We have added hundreds of thousands of hospital beds in the last quarter century, yet vast areas of this country and the people in them are without adequate health care facilities.

These are symptoms, grave signs, of our failure. We are past the stage when an aspirin and a band-aid will help. We need "heroic measures". The manpower shortage I have described in dentistry applies with equal force in medicine.

We have developed public and private systems of health care financing that now cover 85 percent of our population to some degree. Medicare, Medicaid, private health insurances . . . these are economic entrees to the health care system that literally have been seized upon by a public that knows the value of good health and is willing to invest enormous sums to obtain it.

Yet, these very programs have placed demands on our resources that cannot be satisfied. Unless we in the United States are able to make better use of what we have in the way of all health manpower, facilities and funds . . . while we work strenuously to increase them . . . we will witness the collapse of the American health care system followed by some *emergency scheme* that will serve neither the people of this country nor the health industry in any acceptable way.

But true failure is a permanent surrendering, not a temporary setback . . . it is not the falling down, but the staying down.

Our failure in the health area is only a temporary setback . . . it can be instructive . . . it offers us new opportunities . . . new challenges. And I think the challenge we have to deal with first is the one of enhancing the great strengths that are inherent in the American approach to health care delivery, while at the same time correcting the serious, crippling defects that also are part of the picture.

Let me just tell you something about one important effort we in the Federal Government are making toward that objective.

Just a few weeks ago, the House Ways and Means Committee, in approving a number of proposed changes in the Social Security Act, voted to give the Secretary of Health, Education, and Welfare authority to enter into health maintenance contracts with groups of providers such as medical societies, hospitals, medical schools, and private corporations. Under this plan, which the Administration recommended, contractors would agree to provide comprehensive care for Medicare beneficiaries at an annual agreed upon cost, paid in advance. The services provided to those who elected to receive care under this option would include all the care now available under Parts A and B of Medicare, plus additional preventive services.

However, the annual cost per patient would have to be no more than 95 percent of prevailing costs for services under Parts A and B alone in any geographic area. The Secretary would be able to make similar arrangements for Medicaid if a State elected to undertake this kind of health care for its welfare recipients.

This is hardly a revolutionary idea. Nearly six million Americans are now participating in pre-paid health care plans, and there is impressive evidence to show that these people are well cared for indeed.

Among the most efficient prepaid programs, hospital admission rates are below average, manpower requirements are lower, and consequently the overall annual cost of care per patient is less than what we find for comparable groups of people who obtain health care in the conventional way.

But for the Federal Government to propose this approach to all our public health programs is indeed, and would be, *revolutionary*.

These health maintenance contracts are part of an effort to rehabilitate our health care delivery system. Until that system is working efficiently, and will withstand the demand for more personnel and resources, we cannot move on to the equally, if not more important, issue of financing health care.

In many—perhaps most—of the health services programs dental care plays a part. In the Medicaid program, for example, in the fiscal year ending June 30, 1969, a total of $209,000,000 was spent for dental care. In this program the Federal Government pays from 50% to 83% of the costs; the balance is paid by the States. Legally there is no upper limit on the amount the Federal Government will make available under this program for dental care. The limiting factor is the willingness and ability of the States to put up their share. Since only a few States provide comprehensive dental care this expenditure of over two hundred million could be increased greatly if all States were to give dentistry the priority we as a profession know it deserves.

There are many other Federally sponsored dental care programs that indicate the degree of interest of the government in the dental health of our nation. What really is needed, however, is a national coordinated program to provide comprehensive dental service to all low income and needy children. An incremental program starting with the very young and following through their developmental years is the most effective way of approaching the problem of developing a new generation that will reach adulthood with sound dental health. The American Dental Association, the Federal Government and every other responsible agency in the dental health field agree with respect to the need for such a program. What remains to be done is to *do* it!

Let me turn back to the broader aspects of health care which include, but go far beyond, the dental health area. Although we have proposed some radical changes in payment procedures with cost control in mind, the question of national compulsory health insurance or universal coverage looms in the future and must one day be dealt with. Some brave departures are required in that area once we have the delivery system running smoothly.

The stake of the Federal Government in the health field is reflected in the fact that it is cur-

rently purchasing more than 25 percent of the total output of the health care system, while State and local governments are purchasing another 12 percent . . . for a total of 37 percent.

In addition, the three levels of government combined now purchase more than half of the hospital care alone in this Nation.

These figures indicate that the use of its purchasing power is probably the government's primary source of leverage to initiate changes in the organization and delivery of health care.

How are we to use this leverage? To what extent should it be used to change present matters in an essentially private system . . . and to preserve that system?

These are the issues that all members of the health professions must face. The government is going to purchase more and more of the health care system's output. Secretary Finch has predicted that this country may well have a program of national compulsory health insurance within ten years.

Whenever and if it does come, the percentage of health care the government purchases will increase considerably.

And then the era of the private doctor . . . cloistered in his private office . . . lobbying through the traditional institutions . . . out of step with the times . . . will be over.

What has been accomplished in the improvement of health services and facilities to date is the product of the concerns and actions of both the public and the health professions. What will be accomplished in the next decade will be an outgrowth of these same concerns and actions by the public and by the professions. Most of our legislators are forward looking and compassionate people. However, the programs they establish in all fields, and particularly in the health field, must have the support of the public they aim to serve. Without such support they are doomed to failure. After all, it is the public that pays the bill for all such programs. It behooves the public and especially the health professions, to be informed regarding our health problem and concerned enough to make their wishes known to those who represent them in the State legislatures and in the Congress. It is especially the responsibility of the health professions to take the leadership in this area. Dentists are the experts. The public looks to dentists to tell them what is needed to improve our health programming. They look to the profession to represent them in the push for legislative action. By the same token the legislative bodies look to the profession for counsel and guidance.

You, as graduates of this dental school, shortly are to enter the ranks of the dental profession. What I have said about the responsibility of the dental profession applies directly to you. In fact, I would say it applies to you in a very special way. As the youth of the profession, it is expected that you will play a very active role in introducing the innovations I have referred to. We hear much today about youth as activists. While there has been much criticism of some of the excesses of youthful activists, basically it is right and proper that youth should bring new and fresh ideas to

society and its problems. As young dentists, you should bring new and fresh approaches to the practice of dentistry. This is the very substance of progress. Because you are young and new members of the profession, you should not be timid in taking an active role in the formulation of new policies in the profession. Above all, you should not allow the strenuous effort you face in establishing a new practice turn your attention away from the larger problems of your profession and your responsibility in helping to solve them. Because you are young you should be adaptable. Because you are young, you have the vigor needed to push for needed reforms. Because you are young, you should have a larger measure of idealism regarding the health needs of the public. Finally, because you are young, you have more at stake in the future of dentistry than your older counterparts. You have longer to live and to participate in dentistry as it will be practiced in the future. Your personal stakes in what happens to the profession are very high, indeed.

The increased activity of government in the health field is inspired by humanitarian considerations for individuals in need. Equally, it is inspired by practical considerations since the strength of our nation is directly related to the level of health of our people. The actions of the government are a reflection of the growing enlightenment of the public as a whole and the growing concern of the health professions regarding the distribution of health services. As I indicated earlier, in our democracy the government and the public are essentially synonymous. The government in its various components is either elected by the people or employed by them to formulate their mandates and administer the products of these formulations. I emphasize this point for two reasons. First, I want to make it clear that the government is not foisting unwanted programs onto the public. Second, I want to point up the responsibility of the health professions to take an active and continuing role in assisting the government at all levels both in the formulation and administration of such programs. I am sure you feel, and with justification, that you have a heavy investment in your dental education. We must remind ourselves from time to time, however, that the public has an even greater dollar investment in our education. Even more important, the public has made this investment to train you to maintain its dental health. The dental profession exists only to serve the public. It has no other purpose. Furthermore, in granting us a license to practice dentistry the public is endowing us with a form of monopoly. Every citizen has an obligation to contribute to the welfare of the nation. We in the health field have both a special and specialized obligation to contribute to the national welfare. I am sure this graduating class will give unstintingly of its time, its thought, and its special skills to this cause.

Phosphatase Activity In The Dental Lamina And Dental Papilla of Embryonic Mice

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Phosphatase Activity In The Dental Lamina And Dental Papilla of Embryonic Mice

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Abstract—The development of the dental lamina and dental papilla of embryonic mice was followed from their induction to the early cap stage of the dental organ. Differentiation of the dental anlage was found to occur first in the ectoderm and then in the mesoderm. A shift in alkaline phosphatase activity from the ectodermal to the mesodermal component of the dental anlage was also noted.

Introduction

Studies of the level of alkaline phosphatase activity in the ectodermal cells of the dental lamina and the mesodermal cells of the future dental papilla of developing embryonic mice have produced conflicting results. DeFazio in 1954 (Tongue, 1966) and Pourtois (1962) described the presence of alkaline phosphatase activity in the cells of the dental lamina from its earliest stages. The activity is described as being centrally located in the core cells of the dental lamina in early stages with none being present in the underlying mesenchyme. At more advanced stages, alkaline phosphatase activity is described as being increased in the cells of the stratum intermedium of the dental cap, and present in the dental papilla only in cells along its periphery. Ten Cate (1962) found alkaline phosphatase activity in the cells of the stellate reticulum and stratum intermedium of the enamel organ, and in the odontoblasts and subadjacent cells of the dental papilla. He observed no positive reaction in the cells of the dental lamina during its development.

Others have studied phosphatase activity of the more mature enamel and dentinal organs and of enamel and dentine itself (Pourtois, 1962; Ten Cate, 1962).

In this investigation, the maturation and the distribution of alkaline phosphatase activity in the developing dental lamina and underlying dental papilla of embryonic mice was studied. The time span observed was from induction of the dental lamina, as seen at the lightmicroscopic level to formation of the cap stage of the enamel organ.

Materials and Methods

The embryos used in this study were Jax C57/B1-6J pigmented strain of mice developed by Heston in 1949 (Green, 1966). (Jackson Laboratory, Bar Harbor, Maine).

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Pigmented mice were used rather than albinos as the latter, having a neural crest deficiency relative to their formation of melanocytes, might have other neural crest defects. This aspect is important as it has been proposed by deBeer (1947) and others (Platt, 1897) that odontoblasts, especially of molar teeth may be derived from the ectoderm of the neural crest rather than from mesenchyme.

In addition, pigmentation of the eyes and other areas aided in staging the embryos by external appearance (Gruneburg, 1943). The age of the fetuses was determined by the presence of a vaginal plug in the mother and by the external appearance of the embryo itself. Sacrifice of mice pregnant from 10 to 16 days was by cervical dislocation which left the embryos viable until fixed and/or dissected. Because of a marked decrease in maturity of the embryos with increasing distance from the cervical neck only the first two from each side of the uterine chain of the sacrificed mother were taken.

For general histological study, fixation was in 5 per cent formol saline. Portions of the fixed material were dehydrated, embedded in paraffin and stained with hematoxylin and eosin. The Burstone (1960) (Barka and Anderson, 1963) azo dye technique was used to demonstrate alkaline phosphatase activity. The tissues were prepared after Holt (1959) using formol calcium (pH 7.0) for 36 hours at 4°C, followed by immersion in a solution of 0.88M sucrose and 1 per cent gum acacia at 4°C for two or more days. Tissues frozen in the sucrose-gum acacia solution were mounted in a cryostat to allow parafrontal sectioning of both maxilla and mandible (Fig. 1). Sections, cut at 6 *u*, were mounted on albuminized cover slips and dried for two hours at room temperature. Incubation, in a medium employed by Burstone (Barka and Anderson, 1963), was at 37°C and pH 8.0 for 1½ hours. After incubation, the sections were rinsed in distilled water. The cover slips were then washed, dehydrated in alcohol, counterstained with hematoxylin and mounted on slides for evaluation.

Observations

The early dental lamina can best be described as a thickening of the oral ectoderm along a select line, defined by Hay (1961) as the tooth band. In a parafrontal section through the molar region of an 11 day embryo, stained with H and E (Fig. 2), the lamina consisted of superficial layers of stratified squamous cells and a basal layer of columnar cells of the stratum germinativum. The remaining oral ectoderm was bilaminar, a peridermal layer of squamous cells and a basal layer of cuboidal cells.

At approximately the same time that the dental lamina formed, there began a condensation or proliferation of cells in the mesenchyme circumscribing the lamina, as shown in a section of an 11½ day embryo (Fig. 3). This condensation was round to teardrop shape, with the loosely arranged polyhedral cells arranged in a pattern of concentric lamellae around the dental lamina when observed in parafrontal sections. In parasaggital sections through the lamina, a linear arrangement of the mesenchymal cells perpendicu-

lar to the ectodermal surface was seen (Fig. 4). The density of the mesenchymal cell condensation decreased with increasing distance from the ectodermal invagination. Separating the ectoderm from the mesenchyme was a distinct basement membrane.

Serial sectioning of the developing mandible of mouse embryos showed that the initial thickening of the oral ectoderm to form what is described by Hay (1961) as a tooth band was initiated at three distinct areas. Two areas, one on each side of the arch, developed to form the dental lamina of the molar teeth. The third area, on the anterior midline developed into incisors. In this strain of mice invagination was first noted, at the lightmicroscopic level, in the molar region on the eleventh day in utero. As the embryos matured, the three areas merged with proliferation occurring more from the anterior region posteriorly than the reverse. The dental lamina developed more rapidly in the incisor region than in the molar region. These findings corroborate those of Hay (1961) and thus contradict earlier findings of Orban (1928), Schour and Massler (1940), Oóe (1956, 1957), and Glasstone (1938).

Alkaline phosphatase activity in the newly formed dental anlage (11½ days) showed a very strong positive reaction in the areas of the newly formed dental lamina, especially in the cells of the squamous layer (Fig. 5). The reaction was so strong that cell morphology was obliterated. Trace amounts of activity were seen between the columnar cells of the lamina and around the circumferences of the polyhedral cells of the mesenchyme. Meckel's cartilage also displayed a very intense positive reaction.

As development continued, the dental lamina proliferated into the underlying mesenchyme and consolidated its base in the oral cavity. A parafrontal section of a 12½ day embryo (Fig. 6), demonstrated that the deepest layers of the dental lamina consisted of a stratified layer of elongated columnar cells, with stratified squamous cells along the ectodermal surface. Between the delineating surfaces there was a gradual change from one cell type to the other with the predominant cells being polyhedral in shape.

With continued development, as demonstrated by a section of 12½ day embryo in the zones corresponding to the location of future tooth buds, the dental lamina undergoes further proliferation. It greatly increased in size and its relative penetration into the underlying mesenchyme (Fig. 7). In the area of the dental lamina where no teeth are formed, development of both the lamina itself and the underlying mesenchyme became relatively stable, as shown in a section through the dental lamina distal to the first molar of a 12½ day embryo (Fig. 8). As development of the tooth germ continues, the areas of the lamina not intimately connected with tooth development slowly break down and disappear.

Alkaline phosphatase activity at this stage of development (12½ days) was located mostly in polyhedrally-shaped core cells of the dental lamina, but trace amounts could also be seen in the stratified

columnar cells of the lamina and along the basement membrane. (Fig. 9). As in the 12-day embryo, only a slight degree of activity was observed in the condensed mesenchymal cells of the developing dental papilla.

At 13½ days the lamina elongated considerably and was bulb shaped. Its attachment to the ectodermal surface has decreased in diameter. In the neck region, the lateral borders have moved toward each other, decreasing the number of polyhedral and squamous cells between the stratified columnar cells. The laminae in both jaws were medially (lingually) inclined. Alkaline phosphatase activity in the dental lamina was highest along its lateral (labial) border (Fig. 10). Activity was concentrated in the core cells in the area of the future stellate reticulum and in the stratified columnar cells along the basement membrane. A small area of concentration of phosphatase activity was also present along the lateral (labial) aspect of the condensed mesenchyme most distant from the dental lamina itself.

At 14½ days (Fig. 11) the pedicle of the lamina thinned such that, in most sections, only a single row of polyhedral cells separated the two lateral walls of stratified columnar cells. Alkaline phosphatase activity was observed throughout the condensed mesenchyme surrounding the lamina, although it was still most obvious along the lateral border. Within the dental lamina activity decreased slightly but was still concentrated in the cells along its lateral aspect especially in the most basal region. This is the region which will shortly develop into the inner enamel epithelium.

By 15½ days (Fig. 12) the dental anlage could no longer be called the dental lamina. It had now developed into the bud stage of the tooth germ. Within the ectodermal component, alkaline phosphatase activity was localized in the basal cells of the future stellate reticulum and stratum intermedium. The mesenchyme surrounding the ectodermal invagination displayed a very strong positive activity, especially in the cells adjacent to those which are developing into odontoblasts. The future odontoblasts themselves displayed little to no activity. The greatest concentration of activity, once again, appeared along the lateral aspect of the condensed mesenchyme.

At 16½ days (Fig. 13) the tooth bud was entering the cap stage. Activity was markedly decreased in the ectodermal component. It was very strong in the mesenchyme and appeared to be evenly distributed except in the area adjacent to the basement membrane. In a short time activity will be present only in the mesenchymal derivatives of the dental papilla and dental sac without any being present in the ectoderm.

Alkaline phosphatase activity, which localizes areas of proliferation, was first seen in the ectodermal cells of the dental lamina. Initially the activity was limited to more superficial cells of the lamina with none found in the underlying mesenchyme (Fig. 5). With increasing maturation, as the lamina invaginates, localization of activity shifted from the surface of the ectoderm into the core cells (Fig. 9), and then toward and finally

into the columnar cells (Figs. 11 and 12) along the basement membrane.

After a delay of approximately two days, activity appeared in cells along the lateral aspect of the dental papilla (Fig. 10) most distant from the basal lamina. During the time span studied, alkaline phosphatase activity in the mesenchyme also shifted toward the basal lamina into the area where odontoblasts would develop. Movement was from the lateral area of the papilla (Fig. 10) basally and circumferentially around the lamina (Figs. 11 and 12) and at the same time toward the basal lamina. At 16½ days (Fig. 13) activity had not localized in the odontoblastic layer.

Throughout the time span studied no appreciable alkaline phosphatase activity was found in the ectodermal cells lining the oral cavity.

The ectodermal cells along the basal lamina which will develop into the inner and outer enamel epithelium assumed a configuration (long columnar), and orientation closely resembling their final form early in their development (Day 11, Fig. 2). On the other hand, during the time span studied, the mesenchymal cells forming the dental papilla become more irregular in form and did not, in any way resemble highly polarized presecretory odontoblasts.

Discussion

Striking changes occurred in the morphology and distribution of alkaline phosphatase activity in the dental lamina and the dental papilla as they mature toward their future roles as enamel and dentinal organs.

The findings of the present study indicated that differentiation of the dental anlage occurred first in the ectoderm and then in the mesoderm. Both the histochemical and cytological phases of this project seemed to corroborate this.

The classical alkaline phosphatase technique developed by Gomori localizes enzymes that are capable of splitting phosphatase from organic substrates at an alkaline pH. The primary enzyme measured is phosphomonesterase-I with minor amounts of 5′-nucleotidase and adenosine triphosphatases also being measured. The localization of these alkaline phosphatases in tissues are believed to histochemically depict areas which are undergoing localized cell specialization and/or proliferation. (Barka and Anderson, 1963). Serial cross sectional study of maturing mouse embryos revealing a strong positive alkaline phosphatase reaction in the ectodermal component of the dental anlage considerably before activity was observed in the mesoderm (Day 11½, Fig. 5). The apparent rates of proliferation and development of ectodermal cells into the dental lamina and mesodermal cells into the dental papilla were equivalent in the early stages of maturation as determined by cell population counts. Since this was true, it was felt that positive staining for alkaline phosphatase activity indicated areas of cell specialization, leading to the conclusion that the ectodermal component of the anlage matured more rapidly.

The shift of phosphatase activity from the dental lamina to the

dental papilla with increasing development may indicate a shift in the need for cell specialization. This shift occurred when the basal cells of the lamina were long columnar in shape and their configuration could be compared to presecretory ameloblasts of the inner enamel epithelium. The mesenchymal cells of the dental papilla were, at this time, still polyhedral in shape and in no way resembled presecretory odontoblasts. The shift occurred at the time when maturation of the mesenchyme had to equilibrate with the ectoderm in order to lay down co-ordinated enamel and dentinal matrices.

Cellular maturation appeared to follow the basal lamina as it penetrated into the underlying mesenchyme. Thus, a graded reduction in maturation of the ectodermal cell layers occurred from the basement membrane progressing upward to the oral cavity. This finding could have been expected as most ectodermal derivatives such as skin, hair and glands act in a similar fashion. These epithelium and epithelial derivatives also have a graded development from their stratum germinativum, which lie on a basement membrane, up to their free surface.

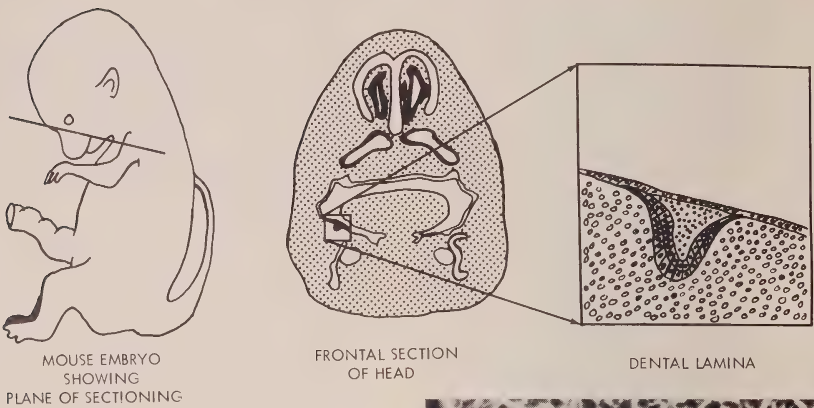
The alkaline phosphatase activity front of the ectoderm also moved along with the basement membrane as it penetrated into the mesenchyme, but was separated from it by one or two cell layers. It only reached the basement membrane when the tooth bud was entering the cap stage and the relative ectodermal penetration into the mesenchyme appeared to have ceased. In the mesenchyme, phosphatase activity moved from the periphery of the forming dental papilla toward the basement membrane and the future active cell layer, the odontoblasts. It had not reached the cell layer bordering the basement membrane at the cap stage of development (Day 16½, Fig. 13).

When concentrations of alkaline phosphatase activity were first noted in the lateral aspect of the forming dental papilla (13½ days, Fig. 10), activity within the dental lamina was also localized along its lateral aspect. This observation was interesting since the lamina, during its development, inclines more and more medially (lingually). Perhaps it was being "bent" around the less active medial portion by the relatively greater proliferation and development along its lateral border. This "toeing in" could also have been aided by the differential proliferation of the mesenchyme which was also more active along the lateral aspect of the lamina than the medial border. The lingual inclination of the dental lamina appeared to stabilize as the phosphatase activity became more evenly distributed through the papilla and lamina. The development of the papilla and lamina also appeared to be more balanced medially and laterally and may act as a braking mechanism to further lateral displacement.

Acknowledgements—This work was supported in part by a Postdoctoral Fellowship Training Grant (5 FO2 DE 33, 684-03) from the National Institute of Dental Research, National Institutes of Health.

The authors would like to thank Mr. J. Heeley for his technical and photographic assistance.

FIGURE 1
General location of sections.



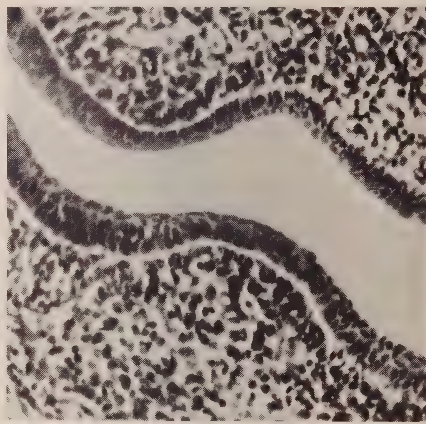


FIGURE 2
Frontal section through the dental lamina in the first molar region of an 11 day mouse embryo. The lamina, located in the lower left of the figure, consists of a superficial layer of squamous cells and a basal layer of columnar cells of the stratum germinativum. Hematoxylin and eosin X 260.

FIGURE 3
Frontal section through the dental lamina in the mandibular first molar region of an 11½ day mouse embryo. A condensation and/or proliferation of cells in the mesenchyme is seen. This condensation is round to teardrop in shape with loosely arranged polyhedral cells forming a pattem of concentric lamellae around the dental lamina. Hematoxylin and eosin X 260.

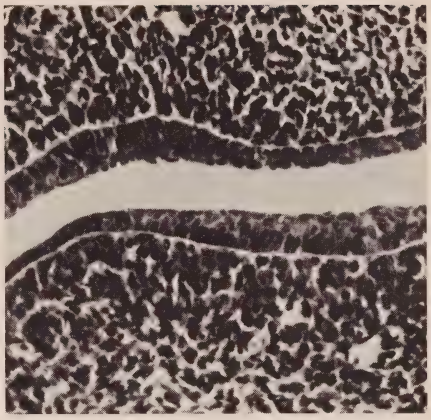


FIGURE 4

Parasagital section through the dental laminae of a 11½ day mouse embryo. A linear arrangement of the cells of the condensed mesenchyme which is perpendicular to the basal lamina and ectodermal surface is observed. Hematoxylin and eosin X 260.

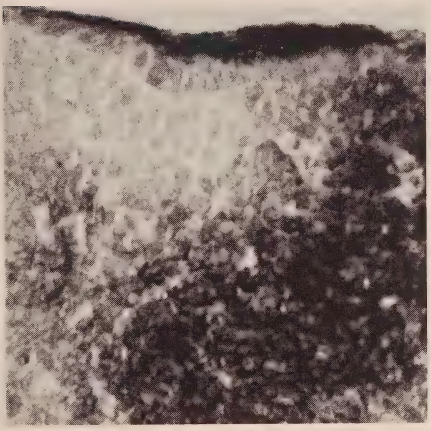


FIGURE 5

Frontal section through the dental lamina in the mandibular incisor region of a 11½ day mouse embryo. A very strong position alkaline phosphatase reaction is seen in the area of the newly formed dental lamina, especially in the squamous cell layers. Meckel's cartilage also displays an intense positive reaction. Alkaline phosphatase. X 260.

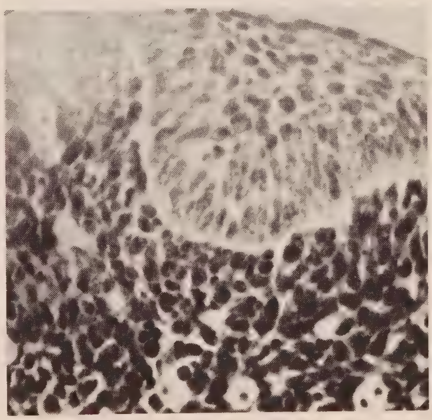


FIGURE 6

Frontal section through the dental lamina in the mandibular first molar region of a 12½ day mouse embryo. The deepest layers of the lamina consist of elongated stratified columnar cells. Stratified squamous cells line the ectodermal surface. Hematoxylin and eosin. X 440.

FIGURE 7
Frontal section through the dental lamina in the maxillary first molar region of a 12½ day mouse embryo. At points corresponding to the location of the future tooth buds, the lamina undergoes further development. The mesenchyme surrounding these areas becomes increasingly condensed and more wide spread. Hematoxylin and eosin. X 260.

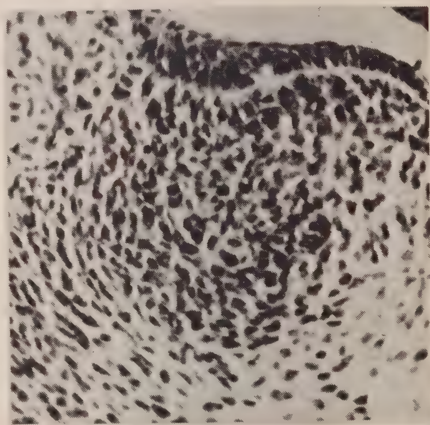


FIGURE 8
Frontal section through the dental lamina distal to the developing first molar in the mandible of a 12½ day mouse embryo. In the areas where no teeth will form, development of the dental lamina and dental papilla become static. Hematoxylin and eosin. X 260.

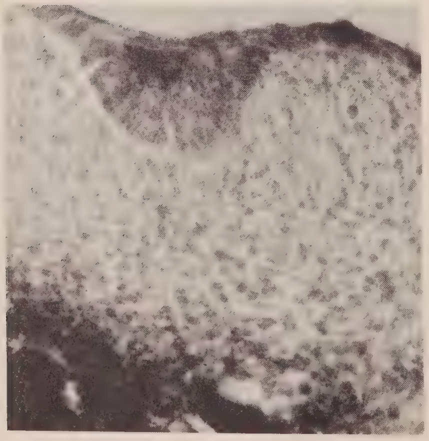


FIGURE 9
Frontal section through the dental lamina in the mandibular molar region of a 12½ day mouse embryo. Phosphatase activity is located mostly in the core polyhedral cells of the lamina. Little to no activity is seen in the columnar cells or in the underlying dental papilla. Alkaline phosphatase X 260.

FIGURE 10

Frontal section through the molar regions of a 13½ day mouse embryo. The lamina has elongated considerably, inclined medially (lingually) and is teardrop in shape. Phosphatase activity is greatest along the lateral borders of the dental lamina and dental papilla. (Medial is to the right of the figure, lateral to the left). Alkaline phosphatase. X 110.

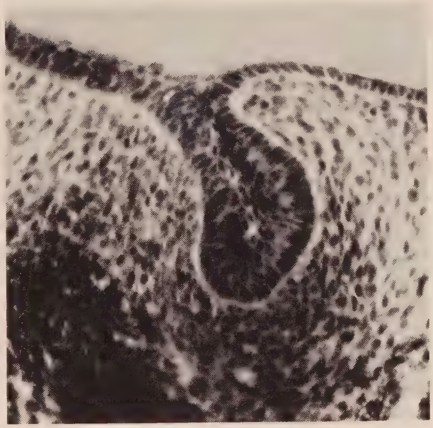


FIGURE 11

Frontal section through the dental lamina in the maxillary molar region of a 14½ day mouse embryo. The pedicle of the lamina has thinned. Phosphatase activity is found throughout the condensed mesenchyme but is still most intense along its lateral border (left). In the lamina, activity has decreased but is still greatest along the lateral border. Alkaline phosphatase. X 260.

FIGURE 12

Frontal section through a bud stage tooth germ in the maxillary molar region of a 15½ day mouse embryo. Activity in the mesenchyme is evenly distributed around the dental lamina except for the cells bordering the basement membrane. Alkaline phosphatase. X 260.

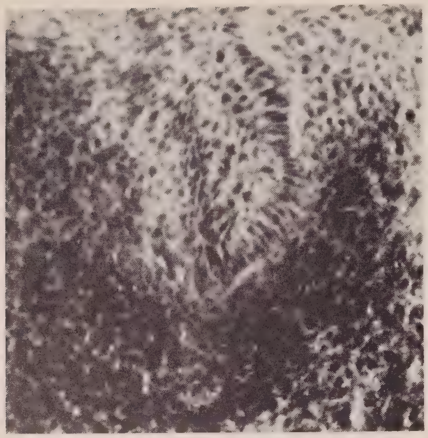


FIGURE 13
Frontal section through a cap stage tooth bud in the maxillary molar region of a 16½ day mouse embryo. Activity is markedly decreased in the ectoderm and increased in the mesoderm. Alkaline phosphatase. X 260.

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Self-Instructional Programs: A Pragmatic Approach

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Self-Instructional Programs: A Pragmatic Approach

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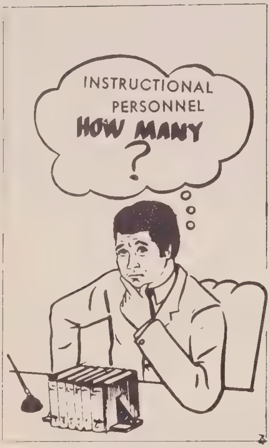
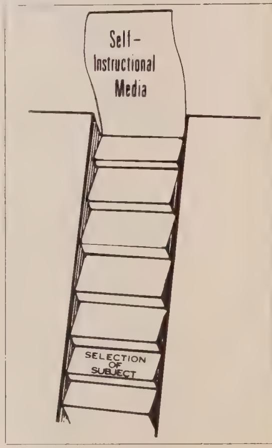


As an educator, how would YOU approach the development of self-instructional materials?

How many instructional personnel in your educational situation would be able to develop self-instructional materials in their area of specialty or provide leadership in the development of such programs?

This article is based on an assumption that few instructional personnel would be able to function effectively in the proposed problem. (This assumption is based on experience gained from working with a number of college faculties and numerous elementary and secondary school teachers.) Therefore, a proposal for the development of self-instructional materials is thought to be pertinent. The approach described in this paper is presently being used at the University of Maryland School of Dentistry with gratifying results.

What are the steps to follow in developing self-instructional programs?



Selection of Subject to be Programmed

Step 1:

The first step proposed in developing self-instructional materials is to select a subject which is appropriate for the intended audience. While taking into consideration an appraisal of student capabilities, it is extremely important that the programmer have a clear, succinct concept of what he is to program.

In selecting the subject matter, there are pertinent questions which should be considered before proceeding to develop self-instructional programs.

	YES	NO
Is there a specific problem to be solved?	X	
Is there a specific need for a program?	X	
Is there a need by teachers?	X	
. . . by students?	X	
. . . by others?	X	
Will the program serve long-term needs?	X	
Can standardization of subject be achieved?	X	
Will the program reduce training time?	X	
Is this the most efficient method?	X	
Will the program release the instructor from repetitive practices?	X	
Is the program economically justifiable?	X	
Can the program be used for basic instruction?	X	
. . . for remedial instruction?	X	
. . . for supplementary instruction?	X	

Equally important are the following questions which should be considered. Otherwise, a great deal of time may be devoted to a program that is not justifiable.

	YES	NO
Is a program presently available commercially?		X
Is the necessary complementary equipment available to carry the program?	X	

Once the subject has been selected, there may be a need for delimitation. This delimitation will aid in the focussing on the "specific" subject to be taught. A subject as broad as dentistry is, of course, too large a topic. Rather, an instructor may go from the general to the specific as illustrated below.

DENTISTRY

RESTORATIVE DENTISTRY

Individual Tooth Restoration

Replacement of Missing Teeth

Intracoronal Restorations

Extracoronal Restorations

Fixed Prosthodontics

Removable Prosthodontics

Partially Edentulous

Completely Edentulous

General Intracoronal Restorations

Cavity Identification and Nomenclature

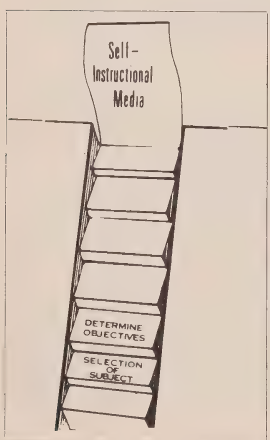
Cavity Preparation

Science of Restorative Materials

Class I Amalgam Preparation and Restoration

GENERAL

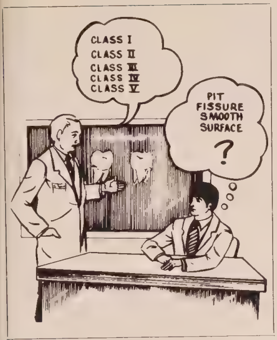
SPECIFIC



Objectives

Step 2:

The next step is concerned with defining the objectives. Those objectives developed for self-instructional programs should be specifically stated so that there is unanimous agreement on the desired terminal student behavior. The objectives, stated as questions, may be the criterion test. Objectives range from the nebulous to the specific, for example:

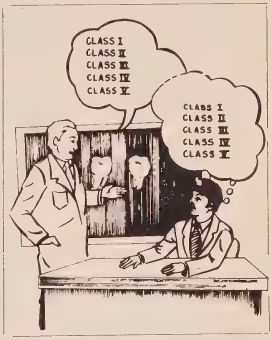


1. A general broad objective would be:

THE STUDENT SHOULD UNDERSTAND CLASSIFICATIONS OF CAVITIES.

In a general objective, there are difficulties in determining when a student "understands." There is also difficulty for the student in determining what desired behavior is expected from "understanding." As a result, there are often disagreements between students and teachers in the degree of "understanding."

2. A more specific objective would be stated operationally or behaviorally, for example:



THE STUDENT SHOULD BE ABLE TO LIST THE FIVE (5) CLASSIFICATIONS OF CAVITIES.

Since this objective is more specific than the general objective listed above, there should be little disagreement among students and teachers when it has been accomplished. Consequently, this type of objective is more desirable when developing self-instructional programs, since the writer must be exact in writing the program to meet the desired objectives. Additionally, the student will be in a position to know specifically what is expected of him as a result of completing the program. Precisely specifying the operational objective helps to accomplish the main intent of the educator. It identifies student behavior that a number of observers can agree on, it identifies student behavior that can be observed, and it identifies student behavior that is reproducible by others who have accomplished the objective.

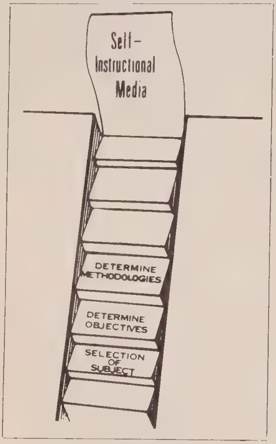
An operational objective may be even more specific, for example:

THE STUDENT, IN A CLINICAL SITUATION, WILL BE ABLE TO IDENTIFY THE FIVE (5) CLASSIFICATIONS OF CAVITIES ACCORDING TO THEIR OCCURRENCE, IN A THREE (3)-MINUTE PERIOD.

In most cases, one would not need to be this specific, i.e., a time limitation of three (3) minutes. However, if the student is to be tested in this manner, then he should be instructed in a manner which will insure that he will meet the objective.

Since operational objectives are desirable in developing self-instructional programs, some practice in selecting words which connote limited meaning may be worthwhile for the novice.

For example, words that limit or restrict their meaning are: list, identify, itemize, contrast and enumerate; words which are open to many interpretations and are often used in general objectives are: understand, appreciate, measure, and determine. "Measure" could be more specific if all of the conditions under which one is to "measure" were covered.



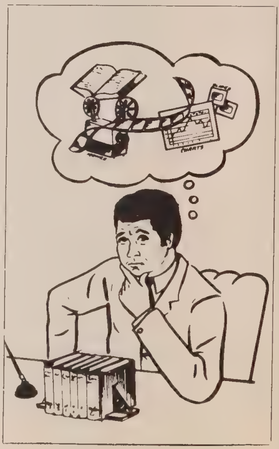
Methodology

Step 3:

After all of the objectives have been operationally stated, the next step is to determine the most appropriate method by which the objectives may be accomplished. Since there may be one approach that is more effective than another, an evaluation of the most effective approach for each objective must be made. Is there a need for more than one method for an objective ? Is there a need for a different approach to each objective or a number of objectives? (A review of currently published audiovisual books will provide advantages and disadvantages of numerous methods.)

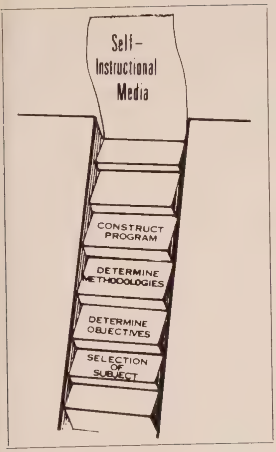
What are some of the methods or approaches?

1. audio
2. print
3. audio/print
4. audio/slides
5. audio/filmstrips
6. print/slides
7. print/filmstrips
8. 8 mm. sound
9. 8 mm. silent
10. 8 mm./print
11. 8 mm./filmstrips
12. 8 mm./slides
13. programmed books



Construction

Step 4:



After objectives and the mode of presentation have been determined, construction of the program may commence. An effective approach in the development of a program is to:

1. Select ONE objective which the student must meet as a result of completing the program.

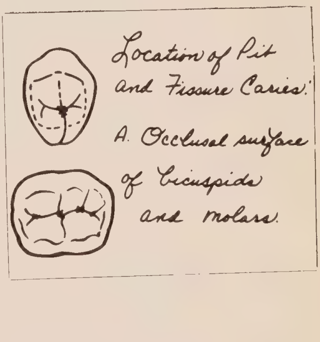
Example: THE STUDENT SHOULD BE ABLE TO IDENTIFY CLASS I CAVITIES.

2. Develop the examination to determine the extent to which the student achieves the objective.

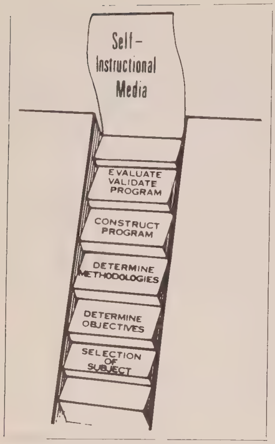
Example: IN THE PICTURED LESIONS, SELECT THE CLASS I CAVITY.

3. The program content is then selected and organized in such a manner which will instruct students. At this point, appropriate and varied methods of presenting the information must be evaluated. The methodology and mode of presentation previously determined in Step 3 may need to be revised. Consideration should also be given to a method of obtaining interaction from students. This feedback may alter the writer's ideas about preconceived methods and modes of presentation.

4. Approaches to the construction of a program will vary from person to person. An effective approach for many persons is to prepare a script on 3″ x 5″ or 5″ x 8″ cards. Visuals or complementary audio may be placed on the left half of the card and the narration on the right half. If constructed responses are needed, place the answer on the reverse side of the card or at the top of the next card.



A novice may find it beneficial to test the effectiveness of the teaching material on the intended audience as soon as possible. This experiment will aid in the method of constructing additional materials in the program.



Evaluation

Step 5:

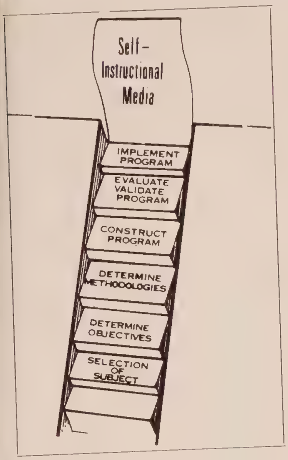
When the material is considered presentable, it should be tested out with groups of students from the intended audience and, on the basis of an analysis of their test performance, revised for student utilization. Evaluation — one primary function of education — is determined by the extent students have achieved the objective of instruction. Consequently, before a teacher can evaluate whether a student has achieved the objectives of instruction, the teacher must be able to state, in terms of pupil behavior, what the student must achieve. Moreover, instructional personnel must be able to specify the processes or activities that a student is expected to display if he has achieved the objective. What do we expect of the student? What action . . .? What behavior . . .? What application . . .? In other words, what things must a student do to show that he has satisfied the objectives? The failure to define objectives in terms of student behavior probably accounts for much of the inadequacy in instruction and evaluation of self-instruction and also for the poor quality of much classroom instruction.

The evaluation of self-instructional program is determined by answering one question—did students learn the information presented? If the answer is YES, the program teaches; if the answer is NO, an examination of the program is in order. Although there are sophisticated test and item analyses, a more pragmatic method is presented for the beginner.

Prepare a sheet of paper with space for students' names and item numbers which required student responses. Place an "X" under the item number which received an incorrect response. This will provide a quick reference of difficult or poorly written areas. Where clusters of "X's" are found, revision of the program is needed. Additional evaluation should

Student	Item								
	1	2	3	4	5	6	7	8	9
825	x				x			x	
826		x	x		x				
827					x			x	
828	x				x				

be conducted in order to validate the teaching effectiveness of the program. This procedure may be time consuming, but is quite necessary if the program is to be effective. In programs where students do not respond to specific items, consultation with students may be necessary to determine areas which are not effective.



Why should one prepare self-instructional programs? First, the programs teach. Equally important, they result in improvements in teaching strategies, for example:

1. As one creates self-instructional materials, he is forced to evaluate the content and mode of presentation.

2. Since the writer produces the self-instructional materials, there is no one to blame but himself if his programs are not effective.

3. Teachers who experience the satisfaction of producing self-instructional materials tend to utilize them.

4. A greater inclination on the part of teachers towards self-evaluation and the solicitation of student evaluation is generated.

Other values of self-instructional materials which are not germane to non-self-instructional materials are:

1. They permit individualized instruction.

2. They often reduce the amount of teaching and learning time.

3. The material may be kept up-to-date.

4. They allow for flexibility in utilization for student and teacher.

5. The media may be used in class, in independent study centers, for independent study at home, and other areas as needed. Of course, in order for this to be possible, media must be put in a format which is readily adaptable to physical and environmental conditions.

6. One of the most valuable contributions of self-instructional materials is that they may be produced and utilized in keeping with specific local needs of both teacher and student.

Characteristics of Self-Instructional Programs

Self-instructional materials should have some characteristics which are evident in every program. The following are some suggested characteristics:

	YES	NO
1. Is the program capable of instructing effectively without assistance or participation by an instructor?	X	
2. Have precise objectives been operationally or behaviorally stated so that achievement may be measured?	X	
3. Has the material been arranged in a logical, systematic or sequential manner which will enable students to accomplish the stated objectives?	X	
4. Has the program been repeatedly tested with students and have consequent revisions been made?	X	
5. Are there provisions in the program for student responses (overtly and covertly) to insure active participation throughout the program? If so, is immediate confirmation or correction of responses provided?	X	

The above list may be extended; however, it does provide a few of the more critical questions which should be answered when evaluating each program.

The most evident and salient changes occurring in today's public schools and universities and those of 15 years ago is not in the curriculum, but in the use of independent learning resources. Recently, the introduction of instructional media—materials and equipment—has brought new devices and techniques of instruction into American education which were not even thought of prior to the 1950's. Therefore, instructional personnel, out of necessity to improve instruction, must develop new techniques of producing instructional media which will enable students to learn in independent learning situations.

Smoking Habits of Dental Students

Olson, Donald L.*, Shapiro, Stewart**, Chellemi, John S.***

Summary

A questionnaire survey was completed relating to the smoking habits of the dental students of the University of Maryland, School of Dentistry. The over-all data is encouraging in that the greater majority of future dental graduates will apparently be non-smokers.

Introduction

It would seem that one of the more susceptible medically related professionals to be influenced by the effects of smoking should be the student in a health professional school. This individual is perhaps most closely associated with the academic approach of the basic sciences, having the most availability to communicate with individuals in pathologically orientated research and teaching programs. A questionnaire type of survey was completed to provide basic behavioral data related to the primary hypothesis that "dental students will decrease their smoking habits as they approach the end of the four-year curriculum," and the alternative hypothesis "that the majority of graduating dental students will not be considered to be smokers."

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Methodology

The student body at the University of Maryland, School of Dentistry was issued questionnaires relating to their smoking habits. The questions were designed to ascertain if the individual was an active smoker and if so, the type of smoking habit; the alternatives would be that the individual was not a smoker now but previously had smoking experience or was not a smoker and had no previous smoking experience. Smokers were established to be those individuals that smoked at least 5 cigarettes daily or the equivalent in pipefuls of tobacco or cigars. 1 cigarette was established to be equal to ½ pipeful of tobacco or ¼ of a cigar.

The population surveyed consisted of members of the freshman, sophomore, junior, and senior students at the dental school. The classes were then divided into two groups for tabulation and analysis of data. Group I was composed of freshman and sophomore students; and Group II was composed of junior and senior students. The rationale for such grouping was: (1) the student population was divided into lower and upper-classmen; (2) the groupings placed all those students who are exposed to more intense patient contact into a separate category; and (3) the students in Group I would have the most recent exposure to the basic sciences.

Results

Tabulation and analysis of smoking and non-smoking experience of

401 students were completed in 1970. There were 204 respondents in Group I, and 197 respondents in Group II. The number of non-participants was negligible and the problem of accounting for non-respondents was for all intense purposes, not necessary. The over-all frequencies and cumulative rates for smokers, non-smokers, and non-smokers with previous smoking experiences are presented in Table I. The actual number of students "giving up" smoking in both groups was 76 representing 19% of the total population. When we add this figure to that portion of the student body which did not smoke, and did not report any previous smoking experience, we observe a cumulative percentage of non-smokers at the time of the survey of 65%. Therefore, 35% of the population can be considered smokers.

It should be made quite evident that although a decrease of approximately 20% of the population from smokers to non-smokers has been observed, the group specific rates are more revealing and thought provoking. Tables II and III present the actual frequencies and specific rates for smokers, non-smokers, and non-smokers with a previous smoking history for Group I and Group II. Comparing the specific rates, Group I not only presents fewer smokers, that is 30.8% of the total Group I population, but also a greater percentage of members of Group I have stopped smoking than members of Group II. The specific percentages of individuals eliminating the smoking habit is 22% in Group I, compared to 15.7% in Group II. Notable is that the non-smokers constitute relatively similar percentages in Group I and Group II, 47% and 44.6% respectively. Therefore, when the total pooled percentages of non-smokers in each group are compared, the category of those ceasing to smoke constitutes the main portion of the difference between the Groups, that is, 6.3% of the 8.7% difference. In order to understand the impact of smoking habits, active numbers of subjects provide limited information, and relative frequencies furnish a more precise account.

Discussion and Conclusions

The hypothesis that students will demonstrate a greater cessation of smoking habits with increased contact with patients cannot be supported by this data. It is apparent that a certain static relationship is presented from this data. Non-smokers tend to contribute approximately the same proportion of students to both groups. It appears to follow that a non-smoker remains a non-smoker. In addition, although the over-all percentage of students ceasing to smoke is 19% of the population of Group I and II in toto, there apparently is a greater tendency for the underclassmen of Group I to stop smoking, 22% compared to 15.7% respectively for Groups I and II. It is significant that 39.5% of the upperclassmen are smokers initially, and remain so, whereas only 30.8%, or almost 10% less of Group I subjects are smokers. The exact meaning of this data is somewhat ambiguous, with the exception that it is encouraging to conclude that 19%, or approximately 1 of every 5 students has stopped smoking by the time of graduation and entrance into the professional community. But to emphasize this

point more precisely, it must be interpreted that the decrease in smokers is not merely 19%, but much greater. The potential non-smokers pool should be considered to be 141 non-smokers, plus 76 non-smokers who were previous smokers. Thus, the possible total is 217, and the 76 who have stopped smoking now can be considered to represent a relative decrease of 35%.

However, the alternative hypothesis that the majority of students in Group II or those closest to graduating can be considered to be non-smokers can be supported by this data. The non-smokers for Group II constitutes 60% of that population. Considering that the over-all total of 65% of the student body are in the non-smoker category, it can be concluded that the greater majority of future dentists will be non-smokers. This can be projected with more support considering the larger pool of non-smokers which will be entering Group II within a two year period.

Table I. Frequency Distribution and Relative Frequency Distribution Smoking Habits for 401 Dental Students.

Classification	*Frequency*	*Relative Frequency (percent)*
smokers	141	35.2
non-smokers	184	45.9
non-smokers/with past history of smoking	76	18.9
	401	100.0

Table II. Frequency Distribution of Smoking Habits of 204 Freshman-Sophomore Dental Students (Group I) and 197 Junior-Senior Dental Students (Group II).

Classification	*Group I*	*Group II*
smokers	63	78
non-smokers	96	88
non-smokers/with past history of smoking	45	31
	204	197

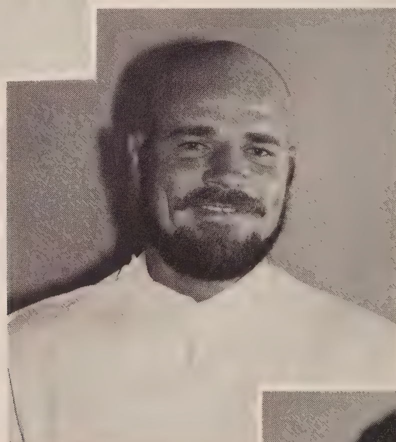
Table III. Relative Frequency Distribution of Smoking Habits for 204 Freshman-Sophomore Dental Students (Group I) and 197 Junior-Senior Dental Students (Group II).

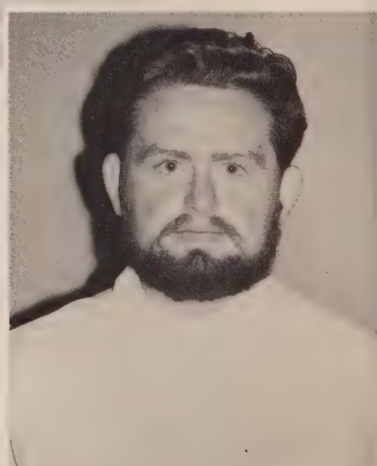
Classification	*Group I (percent)*	*Group II (percent)*
smokers	30.8	39.5
non-smokers	47.1	44.7
non-smokers/with past history of smoking	22.1	15.8
	100.0	100.0

Airborne Contamination of Beards By Dental Aerosols[1]

Nicholas L. Pollok, III, Donald E. Shay, George H. Williams, III

[1]Presented in part before the 48th General Meeting of the International Association for Dental Research, New York, New York, March 17, 1970.





Airborne Contamination of Beards By Dental Aerosols

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Summary

This study investigates the potential hazard of disease transmission possibilities by bearded dental personnel contaminated by dental aerosols. Recoveries of microbial contaminants from bearded dental students following dental prophylaxis of patients suggests that contamination of facial hair by dental aerosols may further potentiate the transmission of infectious organisms to patients, auxiliary dental personnel and family. These studies show that an approximate tenfold increase of facial contamination results when beards are contaminated by microbial flora aerosolized by dental techniques (ultrasonic scaling followed by polishing procedures) in the oral cavity. Further, because of the greater exposure to aerosols containing microbial flora from the oral cavity and a consequent increase in number of potentially infectious microorganisms trapped in the beard, the current practice of beard-wearing by dentists constitutes an unwarranted infection hazard for patients and associates.

Introduction

That man is microbiologically a walking "germ tank" has been demonstrated by numerous studies. However, a recent study by Sciple et al. (1967) which employed the "Microbiotank" to determine the extent of microbial shedding of selected medical personnel has shown that as many as 8 million organisms are liberated into the atmosphere in one hour. Five per cent or approximately 500,000 organisms in these selected students, contained virulent staphylococci recovered from nasal discharges of apparently healthy carriers. Such shedders, should they come in contact with recent surgical wounds, constitute an unnecessary risk of secondary infection to the postoperative patient.

That dental students may potentiate the transmission of pathogenic staphylococci as asymptomatic healthy carriers in clinical training has been described by Shay and Clendenin (1963). In their study from 10 identified carriers, three had organisms resistant to penicillin. Knighton (1960) has shown that dental students and faculty harbor antibiotic resistant staphylococci. Studies by Belting et al. (1964) have demonstrated that dental aerosols from 5 active tuberculous patients have contained viable tubercule cells up to 4 feet in front of the patients' mouths.

The oral cavity of man has been a subject of much study to determine the normal as well as pathogenic flora which inhabit it. We are all aware of the vast potential for airborne dissemination of infectious organisms from the mouth. Airborne dissemination is most easily effected by the current

use of the high speed handpiece and prophylactic procedures with the ultrasonic scaler.

With these predisposing infection potentials in mind, and the current vogue in men today to wear beards, this study determines to what extent facial hair might become a reservoir of potentially infectious organisms when bearded dentists performed routine dental procedures on patients.

To characterize the human beard as an aerosol collector can be analogous to watching a spider web glistening in the sun on a humid summer morning, except that the human beard presents a much greater collection potential due to the thicker matrix of hair. Also, the beard is contaminated with microbial flora indigenous to that of the wearer.

Materials and Methods

Originally, twelve dental students volunteered to grow beards for participation in this study. However, for reasons of personal discomfort, parental influence, social and public discrimination, and associated matrimonial displeasures incurred from wives and mothers-in-law only six students were available at the start of the study. These six dental students voluntarily grew 70-day beards before they participated in this study.

Prior to administering prophylaxis with the ultrasonic scaler, the beards of each student were vigorously scrubbed with an antibacterial skin cleanser which contained 3% hexachlorophene and then rinsed with distilled water. Sterile rubber gloves were used in the scrubbing procedures, and the beards were dried with sterile soft paper towels. Beard scrubbing and rinsing procedures were accomplished in five minutes. In accordance with techniques of skin sampling for microbial contaminants established by Ulrich (1964) from studies at the Mayo Clinic, qualitative contact samples of the beard were taken with Rodac (Rohde, 1963) blood agar plates. This method, according to Ulrich, gives good reproducibility on the same area for approximately the first 5 plates with a slow drop off in count with subsequent sampling.

Once beards were washed, rinsed well and dried, Rodac contact samples of the beard were taken as a control index of normal residual contamination. All samples were obtained from approximately the same site of beard or skin on the right and left cheeks and chin areas. Performance of dental prophylaxis on a patient was achieved and contact samples were again taken. To determine the total microbial count in the beard after performing prophylaxis by serial dilution and aerobic culture, the beard was sheared from each student's face and the hair was blended in 100 ml of heart infusion broth. This procedure was a modification of the Price (1938) technique, which consists of flushing the skin for a prescribed period into a known volume of diluent. The same procedure was used for determining total counts on both stubble-bearded and later clean-shaven faces. Assays of microbial contamination of bearded and stubble-bearded students by dental aerosols were performed all on the same day, whereas, assessment of microbial contamination by dental aerosols on clean-shaven faces was done a week later.

Primary isolation of microorganisms, from beards of dental students on Rodac contact plates and from Bacto heart infusion broth (Difco—No. B38)* rinses of beards, was obtained by culture on Bacto blood agar base media (Difco—No. B45) containing five per cent defibrinated sheep erythrocytes (B.B.L.—No. 11945)**. Morphological identification of microbial flora was obtained by Gram staining of smears of randomly selected colonies from blood agar plates. Some selective consideration was given to the appearance of hemolysis and chromogenicity (Recommended Procedures, 1958) in colonial morphology. Greater significance, however, was attached to coagulase-positive activity (slide test with B.B.L. Coagulase Plasma —No. 40658; Recommended Procedures, 1958), growth and biochemical activity on Coagulase Mannitol Agar (B.B.L.—No. 11115; Esber and Faulconer, 1959), and growth of staphylococcal species on Staphylococcal Agar #110 (B.B.L.—No. 11646; Chapman, 1946, 1952).

Suspected Streptococcal and/or pneumococcal organisms on primary isolation were subcultured on blood agar plates in the presence of a 30-mcg. Neomycin Sensi-Disc (B.B.L. N30—No. 31044) in a heavily inoculated area. Application of Taxo A (B.B.L.—No. 31040; 0.02 units Bacitracin per disc: Petran, 1964; Moffet et al., 1964) or Taxo P (B.B.L.—No. 31046; 5 mcg. ethyl hydrocuprein hydrochloride per disc; Bowers and Jeffries, 1955) Discs approximately 8 mm away from either side of the N30 disc aided in detection and recognition of Group A streptococci and pneumococci in mixed microbial populations after incubation for 24 hours at 35°C. Further differentiation between streptococci and pneumococci was obtained through the "Bile Solubility" test (B.B.L.—No. 11967; Salinger and Geraghty, 1956) for pneumococci and Gram staining.

Hemophilus organisms fished from primary isolation blood agar plates were seen growing as satellite colonies around staphylococci. Transfer to chocolate agar in the presence of a 10-unit Bacitracin Sensi-Disc (B.B.L.—No. 18-004V) resulted in the appearance of typical 1 mm moist pearly colonies on the agar surface after 36-48 hours incubation at 35°C. Gram staining demonstrated tiny gram negative pleomorphic cocco-bacillary forms with tendence to bipolar staining. Speciation of the organisms was not attempted.

Figure 1 is representative of the types and growth of facial hair after 70 days of not shaving by the students. Table 1 shows the amount of residual facial contamination before and after exposure of the face and beard to dental aerosols. Rodac contact samples obtained from the beard in most instances show lower counts resulting from the pre-study wash when compared with counts obtained from beards exposed to dental aerosols generated during the prophylactic procedures.

Contact plate counts in this study do not appear to show any trend as to the degree of facial contamination since contact samples only measure contaminated sites and not the total organismal count. It was assumed that the residual facial and beard contamination would be significantly reduced as a result of the scrubbing

procedures. Counts seen in Table 1 under the "before prophy" heading were unexpected. Even so, in instances later in the study where contact samples were taken before the wash from clean-shaven faces, facial contamination was impossible to enumerate because of the great numbers of organisms.

Table 2 shows the amount of contamination resulting from dental aerosols on stubble-bearded dental students. Rodac contact plate counts are reduced when compared with samples obtained from the same student wearing a beard both before and after administration of prophylactic dental procedures. Recoveries of microorganisms obtained from clean-shaven faces of these dental students tend to show in Table 3 that the samples have reduced levels of contact contamination when compared to bearded or stubble-bearded students. The value of the data obtained from the contact plate samplings indicates that, though washed with an antibacterial skin cleanser, considerable facial contamination persisted on both bearded and non-bearded faces prior to and is increased following exposure to dental aerosols during prophylactic procedures. Table 4 shows the total recovery of organisms obtained from the bearded, stubble-bearded, and clean-shaven students who participated in this study. Total count levels of facial contamination are significantly increased by exposure of bearded students to dental aerosols when compared with counts of organisms obtained from the faces of the same students when clean-shaven. Recovery ratios of a high of 87 to 1 to a low of approximately 10 to 1 suggests that the increase in facial hair may contribute to the collection of airborne microorganisms.

Indirect contact transmission of disease from a microbiological laboratory to persons outside by means of contaminated clothing has been reported for Q fever in laundry workers (Oliphant et al., 1949) and in a veterinarian's wife who may have acquired Q fever by handling the clothing of her husband (Ferris and Brandly, 1964). In nature, contact and airborne transmission of infectious disease from contaminated hair of animals has been demonstrated for a number of diseases. Anthrax, Brucellosis, Tularemia, Q fever, Psittacosis and various other viral and mycotic infections are all examples of this method of disease transmission (Bact. Rev. 1961, 1966).

Recent studies by Barbeito et al. (1967) have shown that a microbiological laboratory hazard does exist when bearded personnel become contaminated with infectious organisms in laboratories handling such agents. Contact aerosol transmission from a contaminated beard on a mannequin to a suitable host was also evaluated by Barbeito with both Newcastle disease virus and *Clostridium botulinum* toxin, type A. The experiments showed that beards retained microorganisms and toxins despite washing with soap and water. Although washing reduced the amount of virus or toxin, a sufficient amount remained to produce disease upon contact with a suitable host. Barbeito further concluded "that, given an equal amount of bacterial contamination, soap and water removes more bacteria from the facial skin than from a beard."

In our study, shearing of the beard and treating the hair in a blender with heart infusion broth demonstrated greater numbers of bacteria recovered than from either the stubble-bearded faces or from the clean-shaven faces. The importance of this method of assay when compared with using Rodac contact plates is that the contact method underestimates the potential infectious dose. This study confirms the observations of Barbeito that bacteria may hold more tenaciously to the beard (both before as well as after aerosol exposure) than to the faces. This speculation is strengthened by noticing that contact samples taken from the washed clean-shaven face show reduced counts when compared with those samples taken from the beard before exposure to dental aerosols, and the beard after aerosol exposure. Counts obtained from stubble-bearded students are correspondingly reduced, but not as much as those seen with clean-shaven faces.

In this study, staphylococci, streptococci, pneumococci, and hemophilus were isolated from the beards contaminated by the dental aerosols. Each of these organisms either singularly or in mixed infections can cause serious illnesses. Often infection follows tissue trauma, an unrecognized nutritional deficiency, or a viral disease that impairs the resistance of the tissue to indigenous organisms. In other cases, the resident organisms express their pathogenic potential only when the infective combination is completed by entry of a different organism not belonging to the normal flora. These organisms can be transferred from infected or contaminated individuals to healthy individuals. Such is the infection transmission potential of beards contaminated by dental aerosols.

Admittedly, we would have preferred to report on data amassed from a greater number of students wearing beards and participating in the performance of dental procedures. Regrettably, this was not the case because of reasons previously mentioned. Certainly, with larger numbers of bearded students in participation, statistical evaluations of the data would have given greater definition of the potential risks of infection transmissibility from beards exposed to the microbial flora found in dental aerosols when compared with clean-shaven students.

Test results, however, do suggest that because of the greater exposure of dentists to aerosols containing microbial flora of this nature from the oral cavity, the consequent increase in number of potentially infectious microorganisms trapped in the beard, the usual tissue trauma associated with most dental procedures, and the predeliction of opportunistic microbes not normally pathogenic to establish infectious foci, the current appeal of fashion to dentists to wear a luxurious growth of facial hair in the form of a beard, mustache or both constitutes an unwarranted infection hazard for patients and associates.

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FIGURE 1.
Bearded Dental Students Showing Growth of 70-Day Beards

Table 1. Contamination of Bearded Dental Students by Dental Aerosols

Student	*Rodac Contact Plate Counts* *Before Prophy*			*After Prophy*			*Total Count** (Price Dilution Tech.)
	Right	Left	Chin	Right	Left	Chin	*After Prophy*
1	381	397	343	>600	>600	>600	9.6×10^4
2	242	256	210	434	429	590	1.7×10^5
3	>600	208	241	>600	>600	>600	1.5×10^4
4	>600	541	>600	>600	>600	>600	7.9×10^4
5	437	325	>600	>600	>600	>600	5.7×10^5
6	223	154	206	526	394	563	3.9×10^5

*Counts based on 1 ml of 100-ml wash diluent.

Table 2. Contamination of Sheared Stubble-Bearded Dental Students by Dental Aerosols

Student	*Rodac Contact Plate Counts* *Before Prophy*			*After Prophy*			*Total Count** (Price Dilution Tech.)
	Right	Left	Chin	Right	Left	Chin	*After Prophy*
1	260	228	257	550	400	585	6.6×10^3
2	164	163	149	438	456	493	1.5×10^4
3	160	147	130	367	209	422	1.6×10^3
4	421	183	150	480	513	505	9.0×10^3
5	177	97	257	231	467	527	5.0×10^4
6	148	270	150	397	498	> 600	2.4×10^4

*Counts based on 1 ml of 100-ml wash diluent.

Table 3. Contamination of Clean-shaven Dental Students by Dental Aerosols

Student	*Rodac Contact Plate Counts* *Before Prophy*			*After Prophy*			*Total Count** (Price Dilution Tech.)
	Right	Left	Chin	Right	Left	Chin	*After Prophy*
1	205	114	241	378	189	>600	1.1×10^3
2	171	159	147	417	211	595	1.1×10^4
3	135	184	141	301	491	273	9.4×10^2
4	93	168	110	375	421	508	8.2×10^3
5	360	197	406	593	468	>600	3.3×10^4
6	141	231	198	476	>600	>600	1.7×10^4

*Counts based on 1 ml of 100-ml wash diluent.

Table 4. Total Counts from Bearded, Stubble-bearded, and Clean Shaven Dental Students Contaminated by Dental Aerosols

Student	Total Count/ml of 100 ml Wash Diluent (HIB) Bearded	Stubble-Bearded—Shaved	Clean Shaven	Recovery Ratio Bearded/ Clean Shaven
1	9.6×10^4	6.6×10^3	1.1×10^3	87.2
2	1.7×10^5	1.5×10^4	1.1×10^4	15.4
3	1.5×10^4	1.6×10^3	9.4×10^2	15.9
4	7.9×10^4	9.0×10^3	8.2×10^3	9.6
5	5.7×10^5	5.0×10^4	3.3×10^4	17.2
6	3.9×10^5	2.4×10^4	1.7×10^4	22.9

Women's Prisons—Available Populations For Dental Research

Part III

The Oral Findings Of Female Inmates In A Detention Center

Stewart Shapiro, D.M.D., M.S.H.*

Burton R. Pollack, D.D.S., LL.B., M.P.H.**

Dorothy Gallant, B.A.***

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Summary

Parts I[1] and II[2] of this series suggested the availability of residents of an institution to participate in dental research programs. The first two papers presented a description of a female correctional institution, its environment and available facilities, and an overview of the dental findings of the residents. Part III describes the dental findings of residents who are not housed in a long term prison, but rather in a detention center, where facilities and period of incarceration present definite difficulties in establishing and maintaining a dental health program. The format of the presentation for Part III of the series follows very closely Part II to aid the reader in making rapid mental comparisons of the two populations being suggested for study.

Introduction

These investigators have validated the similarity between the dental health findings in non-institutionalized females and females in residence in a correctional institution. It has been documented that the residents of a long term correctional institution could serve well in the role of participants in a dental research program.[2] To further our investigation of available populations to be considered eligible for such activities, another correctional agency was evaluated. A survey was completed at the Women's Detention Center in the District of Columbia. A detention center is quite different from a long term facility. A detention center has three distinct functions. Initially, it is the central holding area for all women arrested in an area, in this particular instance, the District of Columbia. It is the location for official documentation and processing of the arrest procedure. Secondly, the women are detained and confined in the center, awaiting further court action. Last, but the least emphasized function, is the care of sentenced female offenders for the purposes of training and treatment. At this center, due to close confinement in the building and lack of adequate outdoor recreational facilities, many long term offenders are transferred to the Federal Reformatory for Women at Alderson, West Virginia.

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Following will be an epidemiologic description of the dental findings of the residents in confinement during March 1970. The availability and recommendation of this population as a dental research source will be evaluated in detail.

Materials and Methods

Dental examinations were completed on all the inmates in residence during the month of March, 1970. Fifty-nine examinations were completed in detail. They were conducted in the dispensary of the institution and scheduled by the dispensary nurses. The dental findings of the subjects were recorded on a standard dental field survey record form (designed by the Biometry and Field Investigations Branch of the National Institute of Dental Research). The form provides the capability of recording DMFS (Decayed, Missing, and Filled Surface) findings for individual teeth as well as the Periodontal Index (Russell)[3,4] and the Simplified Oral Hygiene Index[5] (Greene and Vermillion) for individual teeth. In addition, the form is designed for interpretation and analysis by optical scanning equipment. This report will, however, present only the DMFT (Decayed, Missing, Filled Teeth) findings, rather than the DMFS findings. The basic data in this study was recorded as a DMFS survey, from which the DMFT for each tooth was noted. The Periodontal Index findings as well as the Oral Hygiene findings are also reported.

The examinations were conducted under field conditions, that is, with the use of mirror, explorer and adequate illumination. Radiographs were not used. The examination was performed to determine the status of 28 teeth, the third molars not being included. Thus the difficulty that would confront the investigators in determining accurate classification for any missing third molar teeth was eliminated.

It was established that a subject must have had at least two natural teeth at the time of the examination to be considered eligible for participation in the periodontal portion of this study.

Results

Examinations were completed on 59 subjects, comprising the entire population present during the month of March, 1970. The examination included a complete DMFT, Periodontal Index (Russell)[3,4] and an Oral Hygiene measurement as described by Greene and Vermillion.[5] The mean age distribution for the 59 residents was 28.6 years of age, with 39 subjects between ages 16-30 comprising 67% of the total population. The racial distribution was 55 non-white to 4 white residents.

Table 1 demonstrates the mean total number of decayed, missing and filled teeth of the subjects by age groups. As the age groups advance, we observe a rise in mean total DMFT for the 16-20 years age group from 8.33 to 21.00 and 28.00 for the age groups 41-45 and 46-50, respectively. It should be pointed out at this time, that this rise would perhaps be more exact if the 36-40 age group were considered the extreme in the population being examined, due to the extremely small frequencies of the 41-45 and 46-50 age groups. The entire population showed abundant evidence of prior attack by dental

disease. All age groups showed entries in the three components of the total DMFT, with the exception of the 41-45 and 46-50 age groups, both of which lacked entry into the filled component of the total DMFT. This is quite readily explained by the contribution of this age group to the missing tooth component of the total DMFT. As would be expected, the missing tooth component plays a more prominent role with advancing age, whereas the decayed and filled portions decline steadily as the age intervals increase in chronological order. Similarly, the mean number of sound teeth decreases with age; the mean number of sound teeth being 19.57 at ages 16-20 and declining to a mean number of sound teeth below 10.18 at ages 36-40.

The status of the dental care being rendered to this population, whether from a civilian or institutionalized source, is reflected in the mean filled to mean total decayed-missing-filled tooth ratio (mean F/mean DMFT). This ratio presents a mean value for all age groups of 12%, with the range being from 0% to a high of 23% for the 21-25 year age group.

Table 2 provides the mean Periodontal Index Scores for each age group. The Periodontal Scores were recorded using the criteria (Table 3) formulated by Russell. The mean Periodontal Scores ranged from a low of 1.71 for the 16-20 year age group to a high of 8.00 for the oldest age group. However, due to the small frequency distribution in the 41-45, and 46-50 year age groups, it is more informative to relate the range of Periodontal Index Scores from the low of 1.71 for the 16-20 year age group, to a high of 2.30 for the 36-40 year age group. The mean total Periodontal Index Score was 2.20 for all age groups.

In addition, Table 2 illustrates the corresponding Simplified Oral Hygiene Scores and the Periodontal Index Scores for the different age groups. Numerical data for the oral hygiene status of the subjects in the 41-45 and 46-50 year age groups is not presented. Although these individuals met the basic criteria of possessing at least two naturally remaining teeth, the location of the teeth was not acceptable to oral hygiene scoring procedures. Therefore, the ranges of scores for the total Simplified Oral Hygiene Scores and the components of the total OHI-S Index, that is, the Debris Index and Calculus Index, will be limited to the age groups from 16 to 40. The range of Mean Simplified Oral Hygiene Scores was from a low of 2.04 for the 21-25 age group, to a high of 3.02 for the 31-35 age group. The mean total OHI-S Score was 2.39 for all age groups. Scoring for the OHI-S Index was done according to the criteria as formulated by Greene and Vermillion (Table 4). Contributing to the OHI-S Index Scores, Table 5 provides the numerical data for the Debris Index and Calculus Scores. The mean total Debris Score was 1.45 for all groups considered eligible for scoring procedures, and 0.94 for the mean total Calculus Scores. The scores for the Debris Index ranged from a low of 1.29 in the 21-25 age group to a high value of 1.80 in the 31-35 age group. However, the scores for the Calculus Index ranged from a low of 0.85 in the 21-25 age group to a high value of 1.26 in the 36-40 age group.

Discussion

The purpose of Part III of this series, which is directed toward a search for available populations for dental research is to compare two populations within the classification of correctional agencies. Definite findings are reported that would preclude the suggestion of a detention center or jail for dental research programs, as opposed to support of a prison or long term institution. There are certain similarities of the two populations that were selected for investigation. Both institutions are located within 40 miles of each other, but nevertheless serve different jurisdictions, one being within the District of Columbia, and the other within the State of Maryland. The racial distribution is very heavily non-white in both populations with the women at the Women's Detention Center in the District of Columbia being almost predominantly non-white with a non-white to white ratio of approximately 15 to 1, while there is a 2.5 to 1 ratio of non-white to white residents at the Women's Correctional Institution in Maryland.[2] It is interesting to note that the mean age for all residents in the Women's Detention Center was 28.6 years, which is sharply similar to the mean age of 28.54 years for 157 residents at the Women's Correctional Institution in Maryland during early 1970.[2]

When the oral health and hygiene is considered, the individuals being detained show marked differences. Without extensive discussion of the oral health of the long term residents of the Women's Correctional Institution, the author would like to refer to previous documentation reporting the dental findings at that institution, and summarize those reports by stating that the oral[6] and dental findings[2] were remarkably similar to those reported by the National Health Survey[7 8 9] for non-institutionalized females.

The dental findings reported for those residents at a detention center are relatively similar to those reported in the National Health Survey, as was true of residents of the long term institution. The mean DMFT for all age groups at the Detention Center was 15.2, which is consistent with civilian findings. There was generally a clustering of DMFT per person in this population between 15 and 18 DMFT per person, which follows the same trend in both the civilian and long term institutionalized population. In addition, there was a similar pattern exhibited in the increase of the missing tooth factor with increasing chronologic age, as well as a decrease of scores for the decayed and filled components of the total DMFT.

Observation of the periodontal health offers the most dramatic difference between the two institutionalized populations. The long term residents of the Women's Correctional Institution[6] in Maryland are inclined to resemble the civilian population examined for the National Health Survey, in respect to Periodontal Index[10] and Oral Hygiene Scores.[11] The findings recorded for the residents of the Detention Center employing the scoring criteria for both the Periodontal Index and Simplified Oral Hygiene Index present a much different picture. The presence of well established destructive periodontal disease is documented by the mean Periodontal Index Score

of 2.20 for all age groups. This is in sharp contrast to a mean Periodontal Index Score reported in the National Survey of 1.52 for non-white, non-institutionalized females.[10] Likewise, there is a sharp demarcation between the mean Simplified Oral Hygiene Score of 2.39 for residents at the Detention Center when compared to the mean score of 1.30 for non-institutionalized females.[11]

Since the periodontal findings of a population being detained for short durations of time present obvious dissimilarities with the non-institutionalized population, this segment of incarcerated individuals cannot be recommended for dental research programs. Primarily, this group is not representative of the general civilian population, and it would be extremely difficult to relate dental results of research programs determined from participation of this sample to the universe, so to speak. There are, in addition, several other inherent problems to be considered which negate this particular type of population as a research source. Among the difficulties deserving of attention is the basic fact that the mean sentence of long term residents of a prison is 1.94 years, as reported by Shapiro et al[12], whereas the residents of a detention center are available for participation for somewhere less than 90 days. There would be insufficient time to introduce a research program or establish a secure sample since the degree of mobility of subjects is uncontrollable, and unpredictable. Voluntary participation of individuals who anticipate early departure perhaps would alter their inclination to become part of any program demanding of time and efforts. In view of the rapid incoming and outgoing of individuals, it would be a monumental task to control certain research programs requiring follow-up and careful control procedures that would be demanding of staff and residents. The problems confronting the officials and staff personnel at the detention center are not conducive for the maintenance of a prolonged controlled research program and this situation is in some manner reflective of the oral status of the residents. In this particular sample, the predominant portion of the population were active heroin narcotic addicts and dental health was not the major problem or concern of these individuals. Awaiting trial and court decisions is of concern enough to these women; the lack of preoccupation with oral health and hygiene can be well understood, but difficult to condone by dental health scientists.

(Tables on Following Pages)

Table I. Mean Number of Decayed, Missing, Filled Teeth—Age Groups Starting With Ages 16 and Over for Females

Age Intervals	*Number of Persons*	*Mean Decayed Teeth*	*Mean Missing Teeth*	*Mean Filled Teeth*	*Mean DMFT*
16-20	6	7.33	0.67	0.33	8.33
21-25	19	8.00	4.16	3.63	15.79
26-30	14	8.21	6.93	0.43	15.57
31-35	9	7.22	4.11	2.33	13.66
36-40	9	7.22	9.33	0.67	17.22
41-45	1	2.00	19.00	0.00	21.00
46-50	1	2.00	26.00	0.00	28.00
Totals: $\overline{x}$=28.6 yrs. of age		7.54	5.86	1.76	15.24

Table II. Mean Periodontal Scores and Mean Simplified Oral Hygiene Index Scores—Age Groups Starting at Ages 16 and Over for Females With at Least Two Natural Teeth.

Age Intervals	*Number of Persons*	*Mean Periodontal Index*	*Mean Simplified Oral Hygiene Index*
16-20	6	1.71	2.64
21-25	19	2.01	2.04
26-30	14	2.07	2.51
31-35	9	1.94	3.02
36-40	9	2.30	2.99
41-45	1	6.22	........*
46-50	1	8.00	........*
Totals: $\overline{x}$=28.6 yrs. of age		$\overline{x}$ = 2.20	$\overline{x}$ = 2.39

* Subjects eliminated because location of two remaining natural teeth unsatisfactory for scoring purposes.

Table III. Criteria for the Periodontal Index.

Score	
0	NEGATIVE There is neither overt inflammation in the investing tissues nor loss of function due to destruction of supporting tissues.
1	MILD GINGIVITIS There is an overt area of inflammation in the free gingivae, but this area does not circumscribe the tooth.
2	GINGIVITIS Inflammation completely circumscribes the tooth, but there is no apparent break in the epithelial attachment.
6	GINGIVITIS WITH POCKET FORMATION The epithelial attachment has been broken and there is a pocket (not merely a deepened gingival crevice due to swelling in the free gingivae). There is no interference with normal masticatory function; the tooth is firm in its socket, and has not drifted.
8	ADVANCED DESTRUCTION WITH LOSS OF MASTICATORY FUNCTION The tooth may be loose; may sound dull on percussion with metallic instrument; may be depressible in its socket.

RULE: When in doubt, assign the lesser score.

(Ref: WHO/DH/33)

Table IV. Components of the Simplified Oral Hygiene Index.

A. *Scores and Criteria for Oral Debris*

0—No debris or stain present.

1—Soft debris covering not more than one third of the tooth surface, or the presence of extrinsic stains without other debris regardless of surface area covered.

2—Soft debris covering more than one third, but not more than two thirds of the exposed tooth surface.

3—Soft debris covering more than two thirds of the exposed tooth surface.

(Table IV Continued on Following Page)

(Table IV Continued from Previous Page)

B. *Scores and Criteria for Oral Calculus*

0—No calculus present.

1—Supragingival calculus covering not more than one third of the exposed tooth surface.

2—Supragingival calculus covering more than one third but not more than two thirds of the exposed tooth surface or the presence of individual flecks of the subgingival calculus around the cervical portion of the tooth or both.

3—Supragingival calculus covering more than two thirds of the exposed tooth surface or a continuous heavy band of subgingival calculus around the cervical portion of the tooth or both.

(Ref: JADA. 68:7-13. 1964)

Table V. Mean Debris Index Scores and Mean Calculus Scores Comprising the Mean Simplified Oral Hygiene Index—Age Groups Starting at Age 16 and Over for Females With at Least Two Natural Teeth.

Age Intervals	*Number of Persons*	*Mean Simplified Oral Hygiene Index*	*Mean Debris Index*	*Mean Calculus Index*
16-20	6	2.64	1.72	0.92
21-25	19	2.04	1.29	0.85
26-30	14	2.51	1.49	1.02
31-35	9	3.02	1.80	1.22
36-40	9	2.99	1.73	1.26
41-45*	1	....	....	....
46-50*	1	....	....	....
Totals: $\bar{x}$=28.6 yrs. of age		$\bar{x}$ = 2.39	$\bar{x}$ = 1.45	$\bar{x}$ = 0.94

*Subjects eliminated because location of two remaining natural teeth unsatisfactory for scoring procedures.

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Abnormalities Encountered In The Microscopic Study of 78 Human Fetal Palates

Frank W. Stout, D.D.S., M.S.* and Martin Lunin, D.D.S., M.P.H.**

Summary

Several palatal developmental anomalies have been presented and discussed. These anomalies consist of serial sections from a mesiodens in a 16-week old fetus, a midpalatal cyst from a 17-week old fetus, and an example of Simonart's Band from the palate of a 10-week old fetus. We hope this work will stimulate others to present similar findings so that the relative frequency of these anomalies can be determined.

Introduction

Over a period of several years we have collected and sectioned human fetal palates. During our examination of this material we noted several abnormalities. A survey of the literature disclosed numerous articles concerned with developmental anomalies in the human fetus. However, few of these publications were concerned with the microscopic appearance of human fetal palate anomalies, and of these most considered cleft palate rather than other forms of deviation from normal (2, 4, 5, 6). This paper is presented in order to bring the abnormalities we encountered during the course of our work to the attention of those researchers with an interest in fetal growth and development.

Materials and Methods

Our material consists of 78 human fetal palates that had been collected from the Surgical Pathology Department of University Hospital, University of Maryland. Most of the specimens were the result of spontaneous abortions and were fixed in neutral buffered formalin. After dissection the palates were decalcified in sodium citrate and formic acid, embedded in paraffin, and serial sections were made. Every tenth section was mounted and stained with hematoxylin and eosin. In the areas of interest, the remaining sections were mounted and stained with the appropriate stain for the particular tissue to be emphasized or identified. The ages of our specimens ranged from 7-weeks to 32-weeks. Those specimens that demonstrated lysis of the epithelial components were considered necrotic and were not included among the 78 cases.

Results and Discussion

The first case we wish to present represents a mesiodens in the palate of a 16-week old fetus (Fig. 1-6). As we proceed from Figure 1 to Figure 6 the photomicrographs are taken from every tenth step of the ribbon of serial sections. The sections are approximately six-microns thick so that the total diameter of the tooth in a labial-lingual direction is approx-

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imately 360 microns. As we examined the serial sections we noted that there was a lack of evidence for calcified material, and that the general stage of development seemed to be three to five weeks behind the deciduous maxillary incisors. Saarenmaa considered several theories for the etiology of supernumerary teeth. These theories consider: atavism, post-permanent dentition, division of a tooth germ within the same tooth generation and hyperproductivity (3). The *in utero* development of the mesiodens at a rate which appears to be slower than the deciduous incisors, but more rapid than the permanent incisors, seems to rule out the theory of post-permanent dentition (1). The fact that this mesiodens arises from its own dental lamina, and that this dental lamina is independent from those giving rise to the deciduous and permanent tooth buds seems to indicate that tooth germ division is not the mode of formation. We consider atavism as a mode of transmission rather than a mechanism of formation and in this sense it is unrelated to our topic. Finally, it seems unlikely that hyperproductivity of the deciduous dentition is a factor in this case because the tooth appears to be developing independently and at a different rate than either the deciduous or permanent dentition.

We realize that a single case is not enough to draw a valid conclusion. However, because of the degree and mode of development, Saarenmaa's assumption that some mesiodens are irregular anomalies arising from their own dental lamina and not directly related to either dentition seems valid.

The second case we wish to present represents a large keratin-filled cyst. The cyst was found lying between the palatal bones and the nasal cartilage in a 17-week old fetus (Fig. 7). This cyst lies in an area that in postnatal life would be the anatomic site for a median maxillary cyst. Observation of serial sections did not demonstrate a connection between the lining of the cyst and the oral or nasal epithelium. Because of the position of the cyst, if it were to develop slowly, the cartilage would tend to resist the pressure of expansion and the bone would be resorbed. Eventually, this lesion could have presented the clinical and radiographic picture of a median maxillary cyst.

The final anomaly we wish to demonstrate is a bilateral epithelial band connecting the nasal cavity and the skin of the upper lip in a 10-week old fetus (Fig. 8). This band has been previously described in the literature as Simonart's Band. The school of thought that believes cleft palates are created by a lack of mesodermal proliferation propose that this band is the sole remaining vestige of a fraying epithelial wall. Indeed, in our case there does seem to be some degeneration occurring in the epithelial bands.

If the three-dimensional growth of the fetal head was accompanied by a lack of mesodermal proliferation it is conceivable that the epithelial bands would not receive adequate nutrition due to lack of vascular channels. In this event the bands would tend to rupture and a cleft palate could occur.

Again, we wish to emphasize that our thoughts are derived from

a familiarity with the literature and the cases we have presented. We are aware that our data is not statistically significant, but, if other people will report their findings we may be able to obtain more accurate data regarding pathogenesis and incidence.

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ILLUSTRATIONS

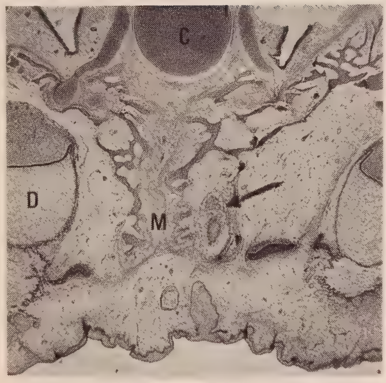

FIGURE 1

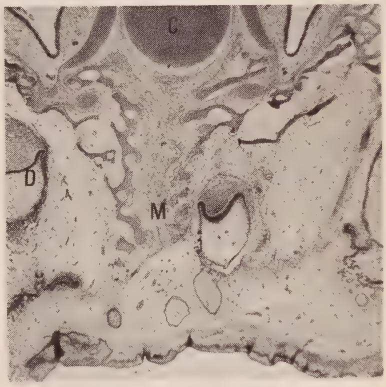

FIGURE 2

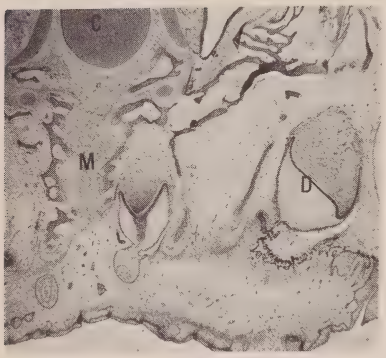

FIGURE 3

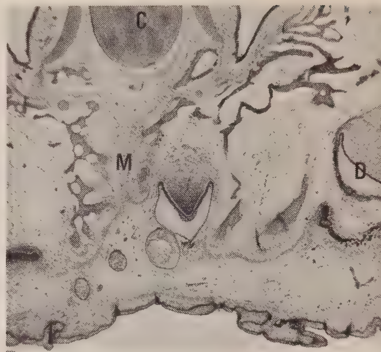

FIGURE 4

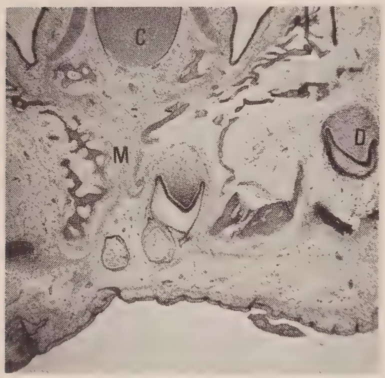

FIGURE 5

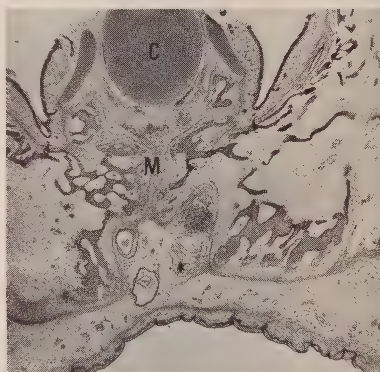

FIGURE 6

FIGURE 7

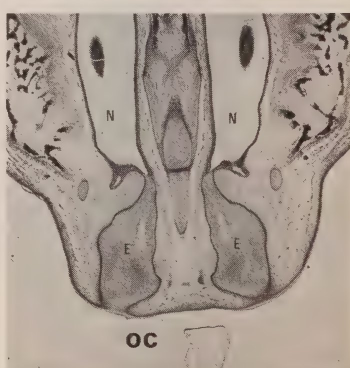

FIGURE 8

FIGURE 1: This section is labial to the midline of the mesiodens. The deciduous incisors (D) and the nasal cartilage (C) can be noted. The arrow points to the mesiodens. (M) indicates the midline of the palate.

FIGURE 2: This section is still labial to the midline of the mesiodens. Note that the supernumerary tooth lies to one side of the midline of the palate (M). (C) indicates the nasal cartilage, (D) indicates the deciduous incisors. (on next page)

FIGURE 3: This section is almost to the midline of the mesiodens. Note the stage of development of the deciduous incisors (D) and the mesiodens. (M) indicates the midline of the palate, (C) indicates the nasal cartilage.

FIGURE 4: This section is slightly lingual to the midline of the mesiodens. Note the definite bell shape of the supernumerary tooth and the notable development of the keratin cyst and rests from remnants of its dental lamina. (C) indicates the nasal cartilage, (D) the deciduous incisors and, (M) the midline of the palate.

FIGURE 5: This section is lingual to the midline of the developing mesiodens. Note that the remnants of the dental lamina have become cystic. (C) indicates the nasal cartilage, (D) the deciduous incisors and, (M) the midline of the palate.

FIGURE 6: This section is completely lingual to the developing mesiodens. A condensation of cells representing the dental sac and keratin cysts from the dental lamina are still evident. (C) indicates the nasal cartilage and, (M) the midline of the palate.

FIGURE 7: This keratin-filled cyst (K) lies in the midline of the palate of a 17-week old fetus. Note the palatal bone (B), the soft palate (SP), and the nasal cartilage (C).

FIGURE 8: Note the epithelial bands (E), connecting nasal cavity (N), and the oral cavity (OC).

Format Recommendations For Contributors

I. General Information

Two complete manuscripts with illustrations should be sent to the Editor, Journal, Baltimore College of Dental Surgery, University of Maryland School of Dentistry, Baltimore, Maryland 21201. The articles which are submitted for publication are expected to follow the format suggested below. It is assumed that the papers are based on original data and that they have not been published or previously submitted for publication in other Journals.

II. Text Sections

Each article should be sequentially arranged as follows:

A. Summary
B. Introduction
C. Materials and Methods
D. Results
E. Discussion
F. Acknowledgements
G. References

III. Text References

References cited in the text should include the author(s) last name and publication year as in "Doe and Brown (1966)". Multiple authorship (more than 2) is initially cited *in toto.* e.g. Doe, Brown and White (1966). Subsequent reference to the multiple authorship (more than 2) should be made as: Doe, *et al.*, (1966).

IV. Bibliographic Reference

A. References cited bibliographically should be alphabetically and sequentially arranged as follows: author(s), year, article, title, Journal (Index Medicus preferred), volume and complete page coverage. Example:

Doe, J. J., Brown, D. M. and White, S. T. 1966. Fibrillogenesis in the dental sac. **The Journal** *21:* 55-63.

B. Author(s) having two or more publications in a given year should be designated as *a*, *b*, etc. Examples:

Doe, S. S. and Brown, D. M. 1966*a*. Heterochromatin in oral epithelial cells. **The Journal** *20:* 73-85.

——— 1966*b*. Cytochemical features of oral epithelium. **The Journal** *20:* 98-110.

C. Book or monograph citations are arranged as:

Doe, S. S. and Brown, D. M. 1966. Inheritance and Development (Edited by White, S. T.) Chapt. 1, p. 16. University Press, Baltimore.

D. References which are in press or are personal communications are given as follows:

Doe, J. J. 1966. Fibrillogenesis in the dental sac. **The Journal** (in press).

Brown, D. M. 1966. (personal communication).

V. Illustrations, Legends and Tables

A. All illustrative material excluding tables should be indicated as figures (Fig. 0), and submitted as mounted glossy prints. The illustrations singly or grouped should not exceed 5″ x 7″. Labels, lead lines, arrows or other designations should be indicated on the print and each illustration should be numbered consecutively. The back of the illustration should bear the following information:

Figure number
Author(s)
Reference to top of illustration.

B. Legends should be brief and should not duplicate text material. Pertinent information including label explanation, technical data such as stains, etc., and magnification should be given.

C. Tables should be typed on separate sheets and should be identified by a Roman numeral and appropriate title. Headings as well as explanations should be concise.

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CONTENTS

Submicroscopic Morphology of the Adult Drosophila Midgut

Leslie P. Gartner

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Submicroscopic Morphology of the Adult Drosophila Midgut[1]

LESLIE P. GARTNER

Department of Histology and Embryology, Baltimore College of Dental Surgery, School of Dentistry, University of Maryland, Baltimore, Maryland 21201.

Abstract The electron microscopic anatomy of the midgut of the adult *Drosophila melanogaster* is described. It is a cylindrical tube consisting of a single layer of trapezoidal shaped parenchyma cells, which possess microvilli. Two layers of striated-like musculature surround this organ. The lumen contains a noncellular membrane, which is assumed to protect the parenchyma. The morphology of the trapezoidal cells suggests that they function in absorption of nutritive materials from the alimentary tract.

Introduction

The fruitfly, *Drosophila melanogaster,* has been the subject of innumerable investigations, and as such it is probably one of the few well known species. Its genetics has been at least as thoroughly studied as that of *Zea mays,* and is probably better understood than that of the mouse. The anatomy and histology of *Drosophila* has been exhaustively treated (Miller, 1950) as has been its early embryology (Sonnenblick, 1950). In contrast, relatively little is known of the fine structural morphology of this organism. Though some electron microscopic observations are available in the literature, the majority of these are limited to the embryonic stages of the fruitfly (Kaufmann and Gay, 1958; Gay, 1960; Mahowald, 1968; Mahowald and Tiefert, 1969; Hillman and Lesnik, 1970; King, 1970). Hence the increased magnifications afforded by the electron microscope are yet to be directed towards the elucidation of the ultrastructural anatomy of *Drosophila* imago. It is because of this that the fine structural investigation of the midgut of the adult fruitfly was undertaken.

Materials and Methods

Lightly etherized fruitflies were placed in a five per cent solution of cold glutaraldehyde, and the midgut was excised. The dissected tissue was transferred to cold, one per cent osmium tetroxide, buffered by veronal acetate at a pH of 7.4 (Palade, 1952). To prevent postmortem necrosis, care was taken to minimize the time interval between dissection and transfer to osmium. The tissue remained in

[1] Work performed during the period of an United States Public Health Service Fellowship in the Department of Zoology and Physiology, Rutgers University, Newark, N. J. The electron microscopy was performed at the Max Wachstein Research Laboratory of the Beth Israel Hospital, Passaic, N. J. Part of this work was supported by research grant AM12818 of the National Institute of Arthritis and Metabolic Diseases.

cold osmium for at least one hour or at most one week. Following fixation the specimens were dehydrated in a graded series of alcohols and finally propylene oxide, and embedded in Epon 812. The blocks were sectioned either on a Porter Blum hand ultramicrotome or on a LKB ultramicrotome, using a diamond knife. Thin sections were mounted on uncoated copper grids and were stained sequentially with uranyl acetate for 10 minutes (Watson, 1958) and lead citrate for 6 minutes (Reynolds, 1963). The tissue was studied with an RCA EMU-3F electron microscope.

Observations

The light microscopic description of *Drosophila* midgut has long been available (Strassburger, 1932; Miller, 1950). It is a cylindrical tube of a single layer of brush bordered, columnar parenchyma cells, surrounded, externally, by an inner circular and outer longitudinal layer of muscle cells. The lumen contains a noncellular, hollow tube, the pleitropic membrane. Individual, small, triangular shaped cells were also reported to be intermixed with the parenchyma. These cells were assumed to be replacements for the spent columnar cells, and were accordingly, referred to as "regenerative cells" (Miller, 1950). The parenchymal cells, at least in the larva, were thought to be both absorptive and secretory in function (Strassburger, 1932).

The electron microscope shows the parenchymal cells comprising the midgut to be slightly trapezoidal in shape. The base of an average cell is about six microns wide while the apex is circa four or five microns from border to border. There are usually 20 to 25 such cells lining the lumen, and the height of an average cell is in the range of 12 to 18 microns. The nucleus is located in the center of the cell, but rather towards the apex than the base (Figs. 1 and 2).

These cells possess most of the normal complement of animal cell organelles, with the notable exception of the Golgi apparatus. This cellular constituent is seldom present, and then poorly developed. The mitochondrial matrix is very dense, further it lacks the small dark granules (Fig. 3) generally associated with it (Peachey, 1964). Both rough and smooth endoplasmic reticula are present, and the orientation of the rough endoplasmic reticulum seems to parallel the longitudinal axis of the cell, except where it follows the contour of the nucleus (Figs. 1 and 2). The microvilli are approximately 1000A in diameter and they are about 1.5 microns long.

The electron microscope also reveals very small cells, the basal surface of which contact the basement membrane. These cells are wedged between the parenchymal cells (Figs. 3 and 4). Their nuclei and mitochondria are appreciably smaller than those of the parenchyma. The size of the endoplasmic reticulum is not reduced (Fig. 4). The origin and function of these cells are not known, though they might represent the regenerative cells noted earlier (Miller, 1950).

The lumen of the gut contains the noncellular pleitropic membrane (Fig. 5). This membrane is composed of a thin outer and a thick inner member, separated by a slightly electron opaque, homogeneous substance (Figs. 5 and 6). Food material is restricted to the lumen formed by the thick inner member of the pleitropic membrane. This member can also be resolved into two portions, a thin inner and a thick outer component (Fig. 7). Since the cells of the adult *Drosophila's* midgut are most probably fixed and non-dividing (Gartner, 1970), they must be protected against loss, and the protective function can, perhaps, be assigned to the pleitropic membrane.

The intestinal musculature of the fruitfly larva has been shown to consist of an inner circular and an outer longitudinal layer of single, striated muscle cell (Sandborn, *et al.,* 1967). The adult midgut musculature reflects a very similar architectural design (Fig. 8), except that the inner circular muscle layer does not necessarily extend completely around the circumference of this organ. The muscle layers are separated from the parenchyma, the peritoneal cavity and from each other by a fibrillar electron opaque material of unknown constitution (Figs. 8 and 9). Each muscle layer is a single myofibril composed of thick and thin fiilaments, probably myosin and actin, respectively. The fine structure of the Z line is unusual in that it presents a jagged appearance (Fig. 9), rather than the straight thin structure of its flight muscle counterpart (Takahashi, *et al.,* 1970). The nucleus of the outer, longitudinal myofibril was evident more frequently than that of the inner circular layer, and was located in the distal region of the cell (Fig. 10). In cross section the thick myosin filaments seemed to be hollow tubules which are surrounded by six or more actin filaments (Fig. 11). The distribution of the filaments and the interfilamental distances are not as ordered and precise as would be expected of striated muscle, suggesting the possibility that this type of muscle might be an evolutionary intermediary between smooth and striated muscles.

Conclusion

The lack of secretion granules and the poor state of development of the Golgi indicate that the parenchymal cells of the midgut of *Drosophila* imago are probably non-secretive in nature. This conclusion is bolstered by the presence of a relatively small amount of rough surfaced endoplasmic reticulum in these cells. Each cell sports approximately 1500 microvilli, and these protoplasmic extensions increase the total surface area of the cell by a factor of circa three. This tremendous increase in surface area suggests that the function of these cells is one of absorption, rather than secretion.

Acknowledgements

I wish to thank Dr. B. P. Sonnenblick of Rutgers University, Dr. H. J. Sobel and Mr. E. Marquet of the Beth Israel Hospital for their interest and encouragement, and Dr. D. V. Provenza for reviewing the manuscript.

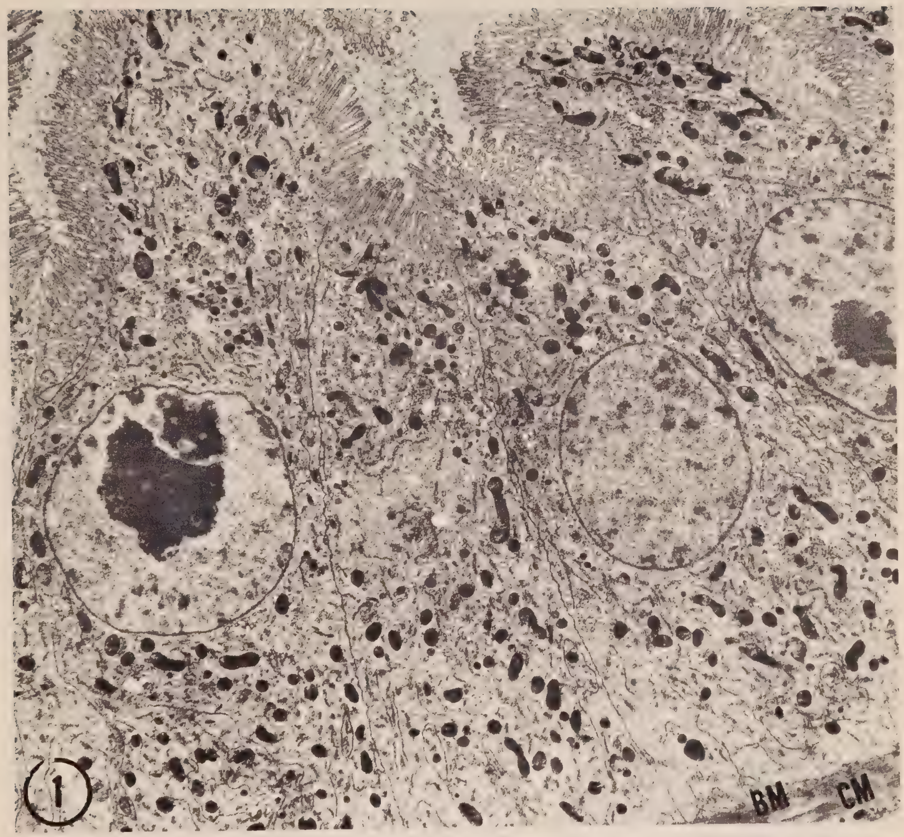

FIGURE 1

Electron micrograph of the midgut of *Drosophila* imago. Note the circular muscle layer (CM) and basement membrane (BM) in lower right hand corner.
X8,100

FIGURE 2

Electron micrograph of the midgut of an adult *Drosophila*. The rough endoplasmic reticulum is oriented parallel to the longitudinal axis of the parenchymal cells. Note the pleitropic membrane (PM) in the upper left hand corner.

X5,400

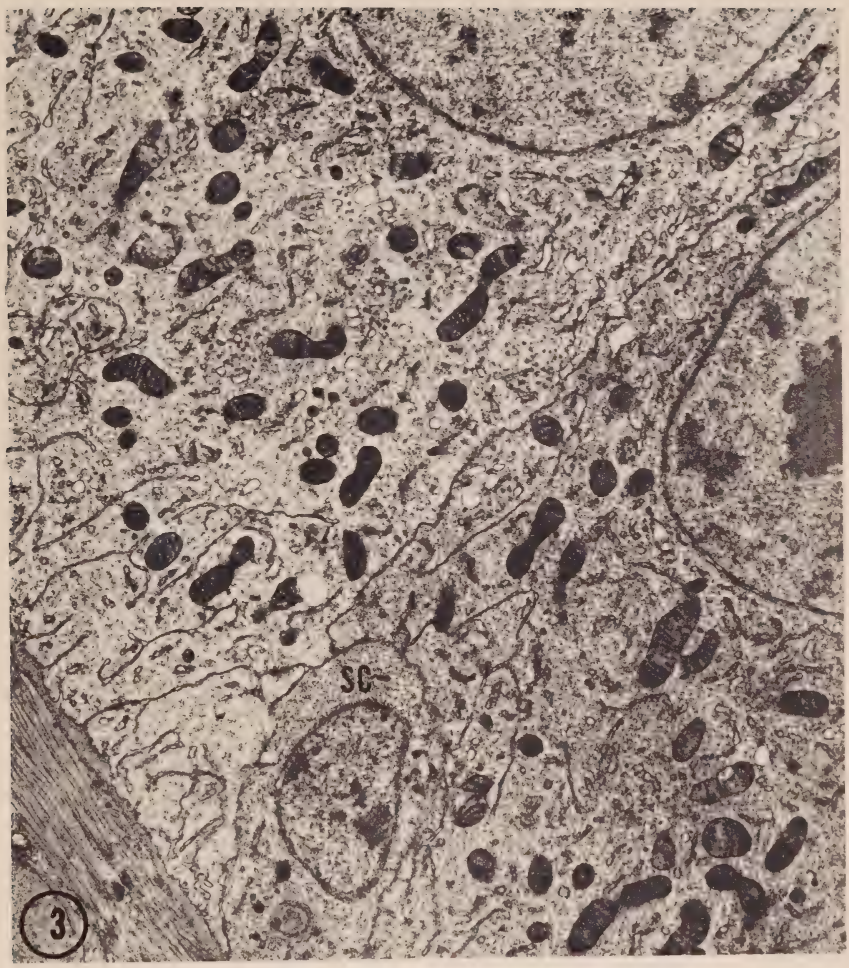

FIGURE 3

Electron micrograph of the midgut of an adult *Drosophila*. Note the presence of a small cell (SC) between the parenchyma cells.

X13,200

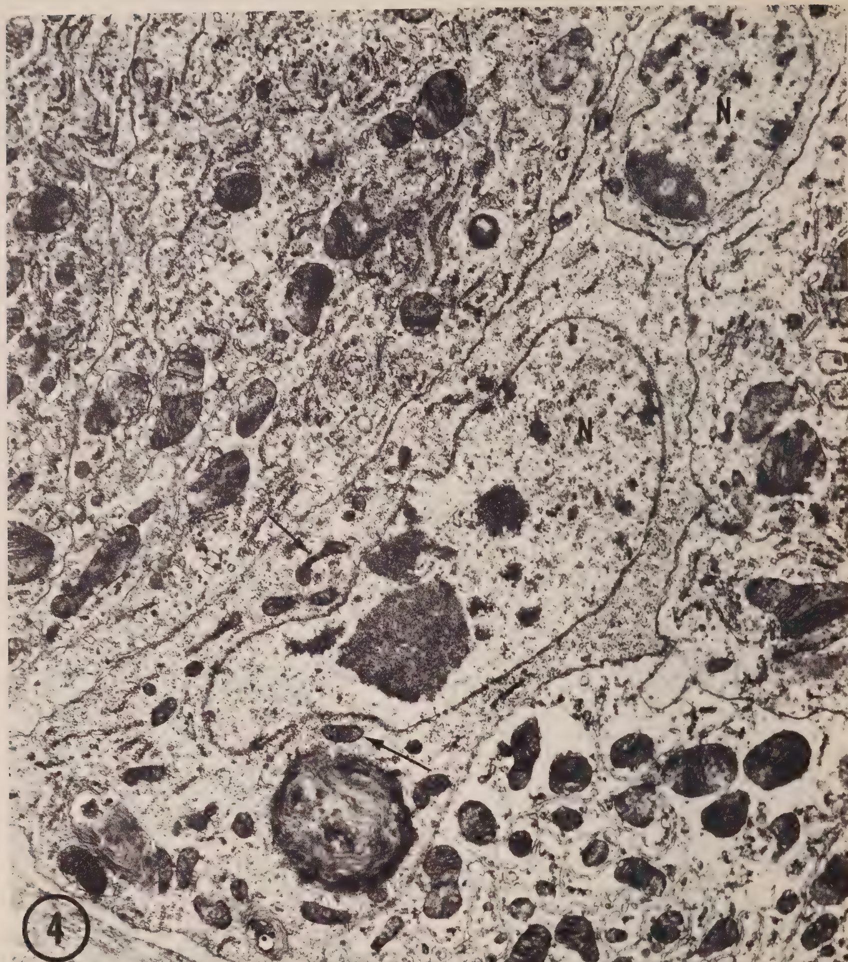

FIGURE 4

Electron micrograph of two small cells. Note the small size of the mitochondria (arrows) and nuclei (N) of these cells.

X13,200

FIGURE 5
Electron micrograph of the pleitropic membrane. Note that the food particles are restricted to the lumen formed by the thick inner member of the pleitropic membrane.

X6,300

FIGURE 6
High power electron micrograph of the marked region of the previous figure. Note the fairly homogeneous electron opaque substance occupying the space between the thick inner and thin outer members of the pleitropic membrane.

X24,200

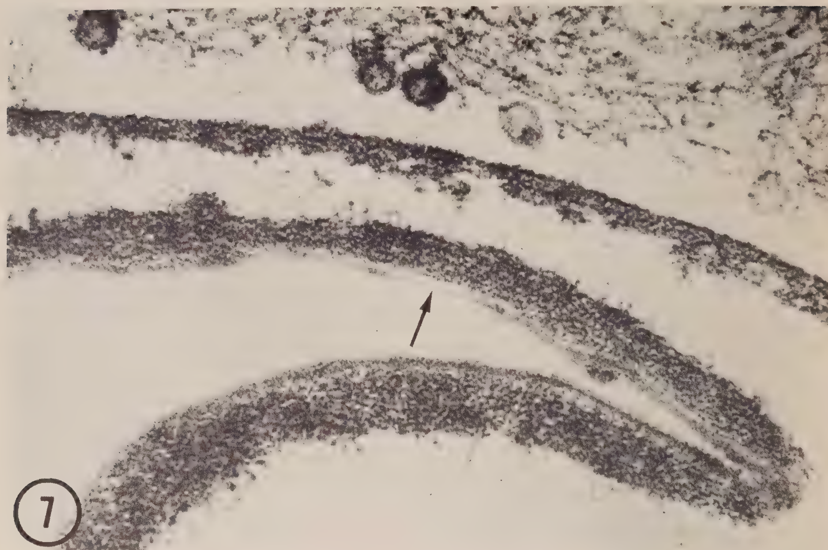

FIGURE 7

High power electron micrograph of the pleitropic membrane. Note the thin inner component (arrow) of the inner membrane of the pleitropic membrane.

X68,500

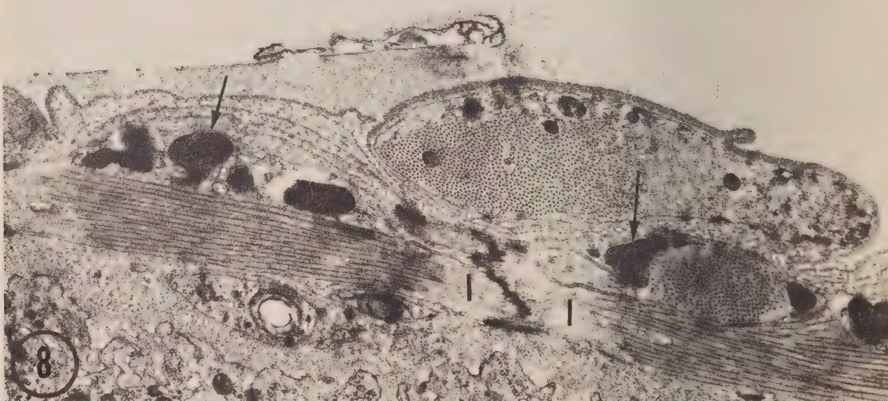

FIGURE 8

Electron micrograph of the inner circular and outer longitudinal muscle layers. Note the mitochondria (arrows) in both circular and longitudinal fibers. The light areas on either sides of the Z line represent the isotropic (I) band.

X14,500

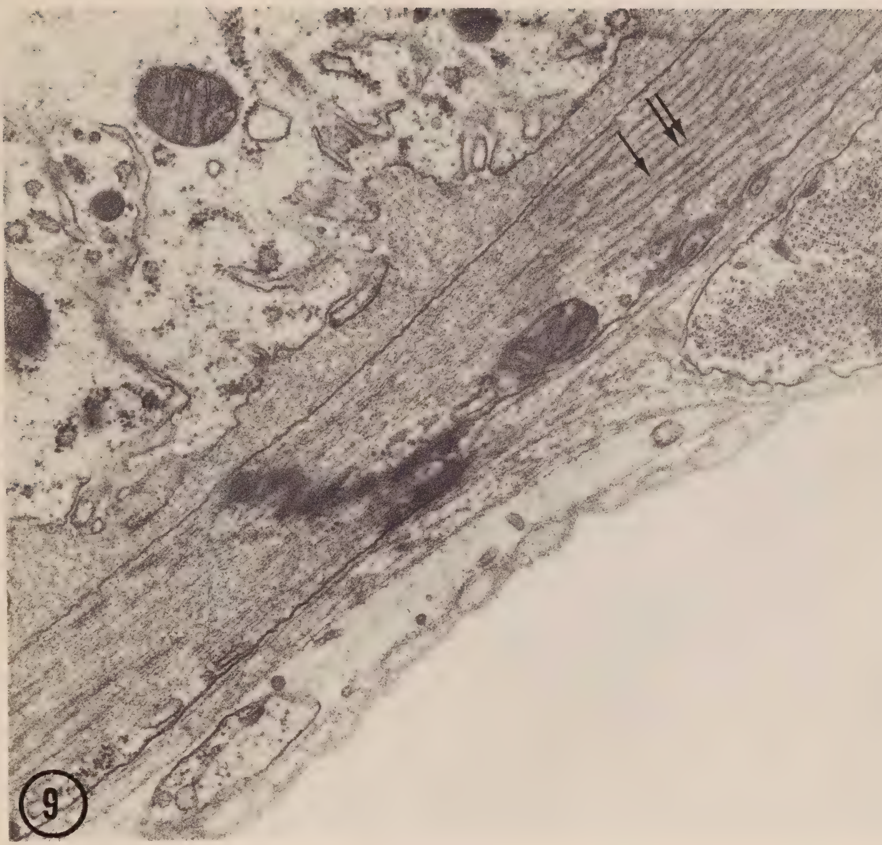

FIGURE 9

High power electron micrograph of the Z line and the adjoining areas. Note the thin actin (arrow) and the thick myosin (double arrows) filaments. The muscle bands are separated from each other by an electron opaque substance.

X27,000

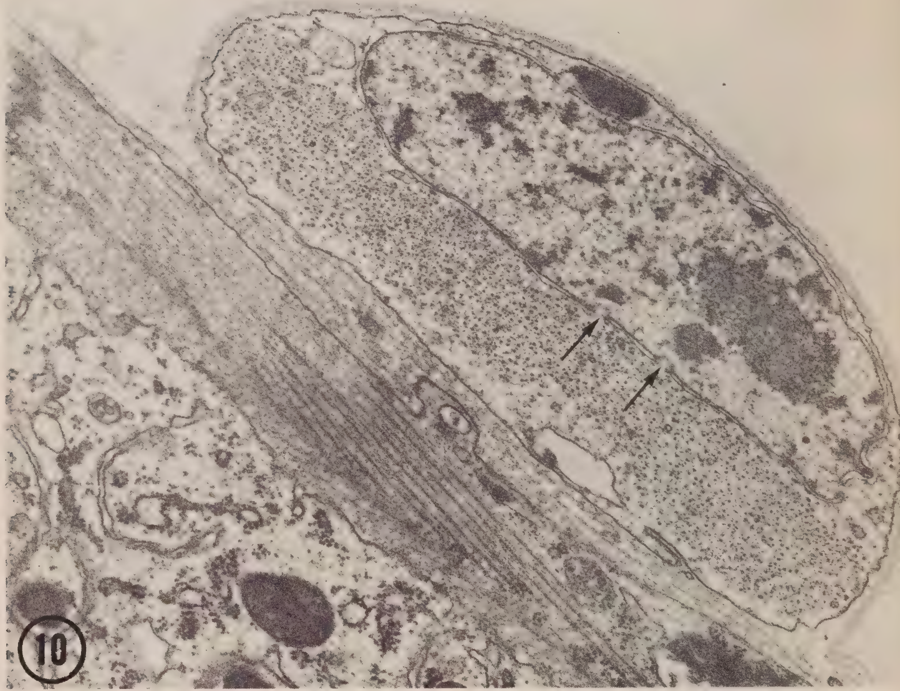

FIGURE 10

Electron micrograph of the intestinal musculature of the adult *Drosophila.* Note the nucleus and nuclear pores (arrows) of the cross section of the longitudinal muscle fiber.

X27,000

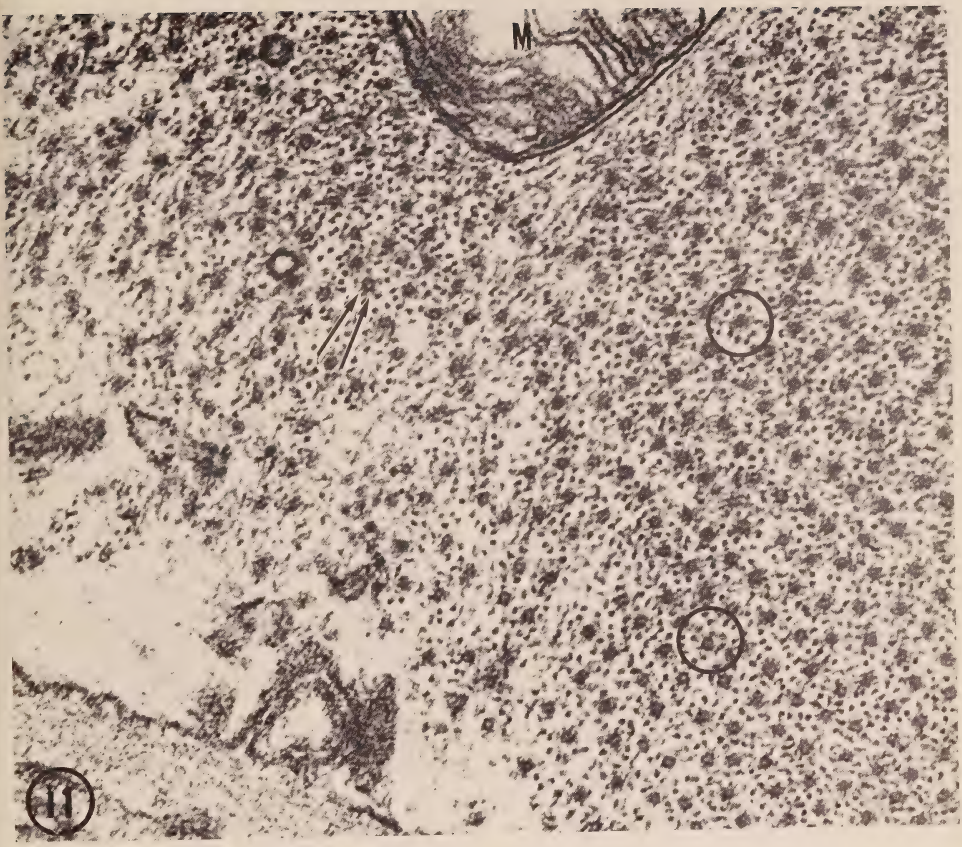

FIGURE 11

Electron micrograph of part of a cross section of an outer longitudinal muscle fiber. Note the thick, tubular myosin filaments (double arrows) surrounded by six or more thin, dense actin filaments (circle). A mitochondrion (M) is top center. X37,400

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Women's Prisons – Available Population for Dental Research

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Women's Prisons — Available Population for Dental Research

Part IV. The Oral Findings of Female Residents of a Long Term Correctional Institution in Massachusetts

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Summary

The scope of this report is limited solely to presenting a dental profile of the female residents of the Massachusetts Correctional Institution. Women's Division. In comparing the results of the Massachusetts study with the dental findings of the Maryland Correctional Institution for Women, the relative similarity in both the observed DMFT scores and total dental caries experience trends, supports the validity of the proposal of using a prison population as a dental research source.

Introduction

The similarity between the dental health findings of non-institutionalized females and females in residence in a long term prison has been documented.[1] In addition, the discrepancy between the dental health findings of non-institutionalized females and females in residence in a short term correctional institution also has been reported.[2] Therefore, the logical progression for suggesting the residents in long term correctional agencies as a dental research population source, is the validation of the dental profile of residents in a similar institution. Another facet that would be demonstrated in a validating type study, is the reliability of the level of cooperation as rendered by both the residents and administrations of these institutions. This would tend to answer the question of ability to perform similar studies in correctional institutions within different geographic regions. The Correctional Institution for Women located in Framingham, Massachusetts, was selected for this study. The Massachusetts Correctional System is similar in management and scope of rehabilitative programs to that of Maryland. In addition, it serves as the central agency for all the New England States, and houses a population similar in number of residents to that of Maryland.

Methodology

Dental examinations were completed for 116 female inmates in residence on May 18th and 19th, 1970, at the Massachusetts Correctional Institution, Women's Division, located in Framingham, Massachusetts. The examinations were conducted in the Dental Offices of the Institution Hospital. The hos-

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pital administration provided a secretary to insure that the residents reported for dental examinations. Each subject was interviewed to obtain individual and group demographic data. A structured interview, previously approved by the Massachusetts Correctional Agency, was completed for each subject, to furnish comparable data accumulated during previous prison studies. Immediately upon completion of the interview the subject underwent a dental examination in an adjoining dental operatory. This report will be limited to the dental profile of the residents. The dental findings of the subjects were recorded on a standard dental field survey form. The examination team was composed of an interviewer, a dental examiner, and a dental recorder. The form utilized for the dental examinations provides for the recording of the DMFS (Decayed, Missing, and Filled Surfaces) for individual teeth, the Periodontal Index[3] (Russell), and the Oral Hygiene Index-Simplified[4] (Green and Vermillion) for individual teeth. The form is designed for interpretation and analysis by optical scanning equipment. This report will, however, present only the DMFT[5] (Decayed, Missing, Filled Teeth) findings.

The actual examination was conducted with the use of mirror, explorer, and illumination, employing the use of a conventional dental unit. Radiographs were not used. The examination was performed to determine the status of 28 teeth, the third molars were not included because no radiographs were taken. The difficulty that would confront the investigators in determining accurate classification for any missing third molar teeth was eliminated.

Following the same protocol as illustrated by the Field Investigation Branch of the NIDR, no carious lesion was diagnosed unless it was demonstrable beyond the possibility of a doubt. A deep pit or fissure was not recorded as carious unless there was more than a catch of the explorer pressure and there was visual evidence of deterioration of the pit or fissure wall. Deep pits or fissures were not considered carious. There had to be an obvious break of surface continuity for the tooth to be considered carious. The examination included a complete DMFS, a Periodontal Index, (Russell) and an OHI-S measurement as described by Greene and Vermillion.

Results

Dental examinations were completed for 116 female inmates. This did not comprise the entire population in residence at the time of the survey. The full complement of inmates totaled 128 women. However, 8 women were in administrative isolation and 4 women did not desire to participate in the survey, thus reducing the population available for examination from 128 to 116. The DMFT counts in this presentation are based on 28th teeth, the third molar teeth being excluded.

The mean distribution for the 116 study subjects, was 31.01 years of age, with a standard deviation of 5.07 years. There was a clustering of individuals between ages 16-30, comprising 60% (70 individuals) of the study population. The white to non-white ratio was 2.14 to 1, respectively.

The mean number of DMFT for the study population is presented in Figure 1. In successive age groups, there is a general rise in mean DMFT scores. For the 16-20 year age group the mean DMFT is 13.81 (± 5.12) as contrasted to 24.50 (± 4.12) for the age group 61 years and older. Although the rise is evident at each individual successive age interval, the staggered effect is readily interpreted as a rising trend in mean DMFT scores.

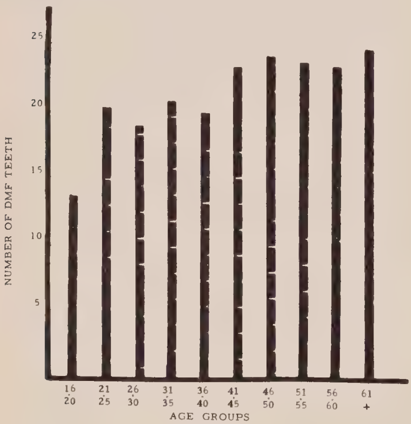

FIG. 1. MEAN NUMBER OF DECAYED, MISSING, AND FILLED TEETH BY AGE GROUPS.

The numerical data contributing to the determination of the DMFT for each age group, is presented in Table 1. The entire study population showed abundant evidence of prior attack by dental disease. All age groups had entries in the three components of the DMFT Index, with the exception of the 51-55 year age group. This age group did not present an entry into the mean decayed component. Emphasis of the mean missing tooth component of the mean DMFT, becomes evident at the 41-45 year old group, with a value of 18.29.

The relationship of each of the components of the total DMFT is presented in Figure 2. It is evident that the missing tooth factor plays an increasing role as age progresses, whereas the decayed and filled portions decline as the age intervals increase.

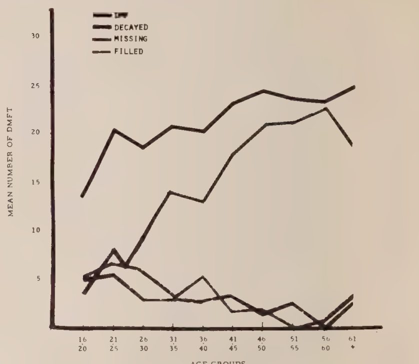

FIG. 2. MEAN DMFT AND DECAYED, MISSING, AND FILLED TOOTH COMPONENTS BY AGE GROUPS.

Although Figure 2 demonstrates a gradual decline in the filled factor of the DMFT as age increases, it should be noted that if we examine the entire concept of treatment rendered by rise of a F/DMFT ratio (Filled Tooth to Decayed-Missing-Filled Tooth Ratio), the curve shows tendencies of skewing to the left when the study population is examined as a cross-sectional cohort population from time of birth (Figure 3). This finding is also evident in Figure

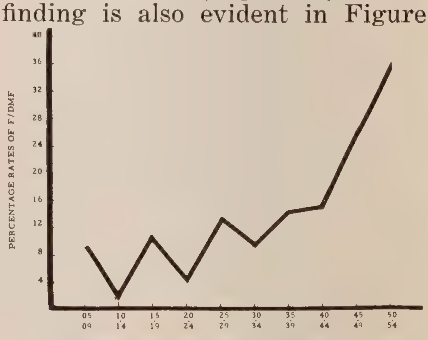

FIG 3. RATIO OF FILLED TEETH TO DMF TEETH.

2, with positive skewing to the right. However, the effect is more pronounced when the F/DMFT percent is plotted against birth date (Figure 3). This is ilustrative of the care being rendered to the younger age groups and perhaps the impact of dental health education reaching young people, even though the highest rate is only 35%, for the 16-20 year age group.

The number and percentages of DMFT per person are illustrated in Table 2. The range of DMFT scores is from 6 to 28. When a percentage of total DMFT per person is examined, there is a marked accumulation of 28.00 DMFT, which comprises almost 21% of the study population. This indicates that approximately one-fourth of the study population was edentulous. Excluding the edentulous group, there was no marked accumulation at any other DMFT score. There was a slight rise at DMFT of 20 to 22, but over-all, the variation between the total scores did not vary more than 7.9% from the lowest to the highest total score.

As expected, the mean number of sound teeth decreases with age; the mean number of sound teeth being 14.19 at ages 16-20 and declining to a mean number of sound teeth of 3.50 at ages 61 and above (Table 3).

Discussion

The objective of this presentation is to reinforce the proposal that female residents of long term correctional institutions should be considered as representing an available population for dental research. The initial prerequisite for selection of a study and/or control population in a project is cooperation of subjects. In addition, if an institutionalized population is selected, support and cooperation by administration is essential, regardless of the type of institution. These investigators conclude that both elements of this prerequisite have been satisfied in studies involving long term correctional agencies, as well as for a detention center. It should also be noted that this characteristic has been demonstrated in three distinct geographic areas; that is, within two states (Maryland and Massachusetts) and the District of Columbia.

To conduct dental research, or dental teaching programs,[6] the target population must either be representative of the general population, or possess a specific characteristic possessed by the target population. In this case, that factor (as the denominator) could be the dental profile of individuals residing within an institution. The residents of a long term correctional institution in Maryland have furnished a dental profile[1] which is consistent with dental findings presented in the National Health Survey for the years 1960-62.[7 8 9] The National Survey was aimed at the non-institutionalized civilian U. S. population. However, the residents of a short term correctional institution were also examined,[2] and it was concluded that the population residing in a detention center presents a dental profile plus other resident and administrative difficulties, which preclude them for consideration as an available source for dental research.

This survey completed in another long term correctional institution supports the original hypothesis that women's prisons, of long term nature, are indeed capable of being considered as excellent research populations. Once again, the residents and the administrative framework are conducive to the satisfactory completion of a dental research project. The dental profile, although characteristically presenting increased DMFT scores, contributes similar trends in total caries experience, when compared with residents of another long-term agency, as well as with the estimates presented in the National Health Survey.

The scope of this report is limited solely to presenting a dental profile of the female residents of the Massachusetts Correctional Institution, Women's Division. Statistical significance testing, and comparisons of the two study populations will be presented in a forthcoming report. To summarize, in comparing the results of the Massachusetts study with the dental findings of the Maryland Correctional Institution for Women, the relative similarity in both *observed DMFT scores* and *total dental caries experience trends,* supports the validity of the proposal of using a prison population as a dental research source.

Table 1. Mean number of decayed, missing and filled teeth by age groups.

Age Intervals	*No. of Subjects*	*Decayed*	*Missing*	*Filled*	*DMFT*
16-29	21	5.10	3.81	4.90	13.81 (±5.12)*
21-25	34	6.82	8.18	5.29	20.29 (±5.24)
20-30	15	6.47	9.47	2.93	18.93 (±4.23)
31-35	13	3.38	14.38	2.92	20.69 (±6.43)
36-40	8	5.12	13.00	2.00	20.12 (±5.28)
41-45	7	1.86	18.29	3.14	23.29 (±4.96)
46-50	6	2.00	21.17	1.17	24.33 (±4.80)
51-55	4	0.00	21.25	2.50	23.75 (±8.50)
56-60	4	0.50	22.50	0.25	23.25 (±9.50)
61 +	4	3.75	18.50	2.25	24.50 (±4.12)

*Standard deviations

Table 2. Number of decayed, missing and filled teeth by number of persons and percent of total.

DMF Teeth	*Number of Persons*	*Percent of Total*	*DMF Teeth*	*Number of Persons*	*Percent of Total*
1	0	0.0	15	5	4.4
2	0	0.0	16	6	5.1
3	0	0.0	17	3	2.5
4	0	0.0	18	6	5.1
5	0	0.0	19	5	4.4
6	1	0.8	20	8	7.0
7	0	0.0	21	9	7.9
8	3	2.5	22	8	7.0
9	4	3.4	23	4	3.4
10	2	1.7	24	5	4.4
11	6	5.1	25	3	2.5
12	2	1.7	26	3	2.5
13	4	3.4	27	0	0.0
14	5	4.4	28	24	20.8
				116	100.00

Table 3. Mean number of sound teeth by age.

Age Interval	*No. of Persons*	*Mean Number of Sound Teeth*
16-20	21	14.19
21-25	34	7.71
26-30	15	9.07
31-35	13	7.31
36-40	8	7.88
41-45	7	4.71
46-50	6	3.67
51-55	4	4.25
56-60	4	4.75
61 +	4	3.50

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A Profile of Prospective Patients at the University of Maryland, School of Dentistry

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A Profile of Prospective Patients at the University of Maryland, School of Dentistry

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Summary

This report presents a profile of prospective patients at the University of Maryland, School of Dentistry Clinic by age, race, sex, place of residence, and method of transportation employed to arrive at the Clinic. The profile reflects the even distribution by the previously referred to attributes.

Introduction

A review of the literature reveals the lack of descriptive data relating to the profile of patients being treated within dental clinic environments. Survival of a dental school clinical teaching program depends on the continual input of new patients. Information should be available to describe to what degree the dental school clinic acts as a treatment resource and is provided patients from within the community. Who is this "taken for granted" patient?

A profile of the dental school clinic population in the majority of instances is provided by personal impressions, present or past. This approach toward a patient profile is not acceptable. A more accurate profile can be obtained simply by tabulation of the characteristics of incoming patients to a dental clinic. In addition, data should be accumulated from available records to furnish a cross sectional profile of registered patients for comparative purposes.

The initial step to accomplish this objective at the University of Maryland, School of Dentistry, has been taken and is described in this study. This report provides a profile of prospective patients visiting the Dental School Clinic.

Methodology

A questionnaire was designed to accumulate data which would provide a profile of individuals seeking dental care at the University of Maryland Dental Clinic. The information form was constructed to facilitate its completion by prospective patients. By definition, the phrase "prospective clinic patient" will henceforth refer to "individuals completing routine application forms to initiate dental clinic ac-

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tion to become active patients receiving dental care." The connotation "clinic" is by no means a categorization of individuals, but refers only to this particular dental clinic.

This study was directed primarily to individuals who were not registered patients, but who intended to become patients by reporting to the clinic.

Review of past admittance records revealed average annual patient admission applications of approximately 5,000 patients. This study gathered data from January 1, 1970 to May 31, 1970. The estimated population for this five month period was 3,000 patients, from which a 33 percent random sample was selected to complete the questionnaires.

Information was collected to provide a profile of the prospective clinic population including characteristics of age, race, sex, marital status, and residence, (Figure 1). Means of transportation utilized in visiting the clinic were also revealed.

Results

The estimation of 3,000 potential patient contacts was quite accurate as 2,970 people visited the Dental School Admitting Clinic during the study period. The purpose of the visits included requests for general and/or emergency dental treatment.

Questionnaires were randomly distributed to 933 individuals (32 percent of the potential population). All of these individuals completed the forms. However, thirty individuals were non-respondents in various categories, and therefore were eliminated in the general profile. In essence, a 32 percent sample was accomplished in regard to residence and related variables, and a thirty percent sample was completed for all categories.

The mean age of the prospective clinic patients was 31.25 years, with a standard deviation of 8.11 years, (Table 1). Individuals in the 21-25 age interval provided almost 15 percent of the total population. Although there was a range in ages of patients frm 2 to 65 or more years, there is a clustering between 11 to 30 years of age. This grouping contributes over 48 percent of the total population.

The non-white prospective patients comprised 55.6 percent of all individuals, whereas the white prospective patients contributed 44.4 percent of the population, (Table 2). It is quite interesting to note that within each race, the total male/female ratios were identical. The overall sex and race distribution of the total population was: non-white males (239/903) 26.5 percent; non-white females (262/903) 29.1 percent; white males (192/903) 21.3 percent; and white females (210/903) 23.2 percent. For both sexes, the non-white population percentages were higher.

Considering individuals above age twenty-one, the marital status for white and non-white individuals (Table 3) was 43 percent and 31 percent, respectively. However, it was interesting to note that in-

formation relating to marital status could not be obtained in an unusually high percentage of non-white individuals. This characteristic was not ascertained in 11 percent of white prospective clinic patients above age sixteen, as contrasted to over 34 percent in the non-white group.

The area of residence for all patients is presented in Table 4. For convenience, a map of the postal zones comprising both Metropolitan Baltimore and the Inner City of Baltimore appears in Figure 2. Although the Dental School Clinic is located in Zone 1, this zone did not provide the highest number of individuals in this sample. Zones 17 and 23, which are adjacent to Zone 1, presented the highest frequencies of prospective clinic patients, with 80 and 83 respectively. It should be noted that the non-white percentage distribution in each of these zones for prospective patients was 95 percent (Zone 17) and 84 percent (Zone 23). The zones immediately adjacent to Zone 1 contributed almost 40 percent of the total prospective clinic patients.

Metropolitan Baltimore provided 90 percent of the sample prospective clinic population. Only 93 (10 percent) of the 933 sample population lived elsewhere. The Metropolitan patients were drawn from 33 of 37 postal zones.

The methods of transportation employed by the prospective clinic patients for the initial visit only are presented in Table 5. Almost 75 percent of the people came by automobile or bus, each method contributing approximately 37 percent. Seventy-three percent of the 112 people who walked to the clinic resided in zones immediately adjacent to the one in which the Dental School Clinic is located.

When questioned as to transportation for subsequent dental appointments, the overwhelming majority of individuals reported similar means as for the initial visit.

Discussion

This study is unique in that it does not attempt to describe the existing population of the Dental School Clinic. A profile of the present population would introduce spurious interpretations of the data because a significant proportion of individuals would have been patients for many previous years. The variation in "time of being a registered clinic patient" would confound a profile. Thus, the hidden variable of "time exposure" is eliminated by this study design.

The sample population of this survey projects a uniform distribution of patients in the areas of age, sex, and race. There was no attempt to establish a socio-economic or dental profile in this study. Both of these attributes will be investigated in another track in the progression of this study.

It was established that the non-white population contributed approximately 55 percent of the total prospective patient sample. Within each race, the male/female ratios were identical, with females in either race contributing 52 percent. However, when contrasted to the general population, the non-

white female presented the highest percentage of individuals (29 percent) while the white males had the smallest segment of prospective patients with 21 percent. The difference between the highest and lowest sex-race group was only 8 percent of the total population. Thus, it might be concluded that there is a relatively uniform distribution of patients, especially relating to either race and/or sex. Within each age interval there is a variation of the male/female ratios, but there is an overall accommodation between age intervals to balance both sides of the fulcrum of the profile.

An interesting observation was the significant number of males, of either race, in the working class ages beginning with 16 years. It has been the impression of many that clinic populations would be limited in this group. However, this sample negates this idea by demonstrating that a significant proportion of prospective clinic patients are adult males.

The mean age of all patients is 31.25 years. This is significant insofar as "teaching cases" are concerned. It must constantly be emphasized that teaching is the primary objective of a Dental School Clinic, and that provision of dental care must take a secondary role, regardless of its importance. The mean age of the prospective patients presents a population that will provide a broad scope of existing dental disease. There is an equally good distribution of prospective patients at both ends of the age scale, satisfactory in race and sex ratios.

Ascertainment of marital status for individuals over 16 years of age presented an interesting discrepency according to race. For reasons which are elusive at this time, more than three times the relative percentage for whites, the non-white prospective patients did not desire to volunteer their marital status.

It was anticipated that the majority of prospective patients would reside in Metropolitan Baltimore. This was confirmed, as only 10 percent of prospective patients resided outside of the area. However, it should also be emphasized that the zones immediately adjacent to the zone in which the Clinic is located provided 40 percent of the prospective patient sample. In addition, it was observed that approximately 70 percent of the population resided within what is considered to be a resource for dental care by the local residents. These zones of residence provided a prospective patient population which was predominantly non-white. The convenience of the location of the clinic is evident in that 75 percent of the patients who walked resided in postal zones immediately adjacent to, or in the same zone as the Dental School Clinic. The location of the facility and methods of transportation available assume important roles. Public transportation and walking comprised almost 50 percent of travel methods.

Summary

A profile of the prospective clinic patients at the University of Maryland, School of Dentistry Clinic can be described as follows:

"The prospective clinic patients are equally distributed by race (white or non-white) and by sex (male or female); and approximately 31 years of age. The individual most likely resides within Inner City Baltimore, and walks and/or uses public transportation to come to the Clinic."

This profile is encompassing, but reflects the even distribution of prospective clinic patients by age, race, sex, place of residence and method of access to the clinic.

Such a range of individuals supports both the teaching and service perspectives for a Dental School Clinic. This uniform array of individuals will serve to provide dental students with a satisfactory cross-sectional representation of the general population in regard to race, age, and sex.

In addition, although teaching is the main objective of any Dental School Clinic, the local residents apparently regard the clinic as serving a community need. Such a relationship with the community in which a dental school is located does present certain difficulties, but such a synergistic relationship is not undesirable in view of current social upheavals.

These investigators are conducting additional investigations directed at documenting a cross-sectional profile of registered patients, as well as increasing the impression profile of this sample. Additional variables will include items relating to socio-economic status as well as a profile of the status of dental health. In addition, the logical progression of obtaining data in this study would include a dental profile of the patients obtaining dental treatment at the University of Maryland School of Dentistry. A similar survey of the residents of the Inner City zones which provide the bulk of clinic patients should also be documented. This would provide denominator data as to the population density, dental demands of the community, and dental health needs of the community. Such data will enable the valid assessment of the University of Maryland School of Dentistry Dental Clinic as a community health center.

Table 1: Distribution by age of a sample population of patients at the initial visit seeking dental care at University of Md. School of Dentistry Clinic from Jan. 1, 1970 to May 31, 1970.

Age Intervals	*Frequencies*	*Percentage of Total*
1- 5	25	2.7
6-10	60	6.7
11-15	100	11.0
16-20	99	11.0
21-25	133	14.9
26-30	103	11.4
31-35	65	7.1
36-40	47	5.2
41-45	69	7.7
46-50	39	4.3
51-55	48	5.3
56-60	37	4.0
61-65	25	2.7
65 +	53	6.0
TOTAL	903	100.0

Mean = 31.25 yrs.
S. D. = ±8.11 yrs.

Table 2: Distribution by age, race, and relative sex distribution of a sample population of patients at the initial visit seeking dental care at Univ. of Md. School of Dentistry Clinic from Jan. 1, 1970 to May 31, 1970.

Age Interval	*Freq.*	*White* *% Male*	*% Female*	*Freq.*	*Non-White* *% Male*	*% Female*
1- 5	12	41.6	58.4	13	23.0	77.0
6-10	25	60.0	40.0	35	37.1	62.9
11-15	53	45.2	54.8	47	57.4	42.6
16-20	32	43.7	56.3	67	53.7	46.3
21-25	75	52.0	48.0	58	41.3	58.7
26-30	43	46.5	53.5	60	53.3	46.7
31-35	20	45.0	55.0	45	42.2	57.8
36-40	14	64.2	35.8	33	54.5	45.5
41-45	20	50.0	50.0	49	34.6	65.4
46-50	21	38.0	62.0	18	66.7	33.3
51-55	20	50.0	50.0	28	39.2	60.8
56-60	19	31.5	68.5	18	44.4	55.6
61-65	15	60.0	40.0	10	60.0	40.0
65 +	33	42.4	57.6	20	65.0	35.0
TOTAL	402	47.7	52.3	501	47.7	52.3

Table 3: Distribution by age, marital status, and race of a sample population of patients population of patients at the initial visit seeking dental care at University of Md. School of Dentistry Clinic from Jan. 1, 1970 to May 31, 1970.

Age	*Total*	*White* *Married*	*Single*	*Other**	*U.K.*	*Non-white* *Married*	*Single*	*Other**	*U.K.*
16-20	99	2	28		2		48	1	18
21-25	133	21	48	5	1	15	22	4	17
26-30	103	28	11	2	2	27	14	5	14
31-35	65	14	1	4	1	24	5	6	10
36-40	47	9	4		1	12	3	7	11
41-45	69	12	1	3	4	24	2	9	14
46-50	39	13		2	6	6	2	1	9
51-55	48	13	3	1	3	9		6	13
56-60	37	11	2	2	4	2	1	2	13
61-65	25	8	2	3	2	5		1	4
65 +	53	9	5	9	10	3		3	14
TOTAL	718	140	105	31	36	127	97	45	137

*This category includes separated, divorced, and widowed persons.

Table 4: Relative percentage distribution by zone of residents at the initial visit seeking dental care at Univ. of Md. School of Dentistry Clinic from Jan. 1, 1970 to May 31, 1970.

Zone	*Frequency*	*Relative Percentage* *White*	*Non-white*
1	58	48.2	51.8
2	35	25.7	74.3
3	....	....	....
4	8	100.0	....
5	12	75.0	25.0
6	14	78.5	21.5
7	30	56.6	43.4
8	2	50.0	50.0
9	8	100.0	....
10	4	50.0	50.0
11	8	75.0	25.0
12	41	39.0	61.0
13	30	13.3	86.7
14	11	81.8	18.2
15	57	21.0	79.0
16	57	....	100.0
17	83	4.8	95.2
18	49	36.7	63.3
19	2	50.0	50.0
20	3	100.0	....
21	8	100.0	....
22	17	70.5	29.5
23	80	16.2	83.8
24	22	100.0	....
25	36	25.0	75.0
26	2	50.0	50.0
27	28	82.1	17.9
28	13	84.6	15.4
29	52	46.1	53.9
30	45	53.3	46.7
31	14	35.7	64.3
32	....	....	....
33	....	....	....
34	7	100.0	....
35	....	....	....
36	3	100.0	....
37	1	100.0	....
Other	93	82.7	17.3
TOTAL	933	44.6	55.4

Table 5: Distribution and relative frequency by place of residence, and means of transportation utilized by patients for initial visit at the Univ. of Md. School of Dentistry Clinic from Jan. 1, 1970 to May 31, 1970.

Zone	*Freq.*	*Relative Percent of Total*	*Taxi*	*Means of Access to Clinic*			*N. V.*
				Bus	*Car*	*Walk*	
1	58	6.2	9	7	5	35	2
2	35	3.8	10	16	5	3	1
3	....	....	....	....	....	....	....
4	8	.9	....	2	6	....	....
5	12	1.2	1	4	5	2	....
6	14	1.6	....	4	8	2	....
7	30	3.2	9	18	1	1	1
8	2	.2	....	....	2	....	....
9	8	.9	1	1	6	....	....
10	4	.4	....	....	4	....	....
11	8	.9	....	3	5	....	....
12	41	4.3	2	12	21	2	4
13	30	3.2	6	14	8	2	1
14	11	1.1	....	7	3	1	....
15	57	6.1	3	24	32	1	....
16	57	6.1	7	28	18	....	....
17	83	8.9	7	39	25	9	3
18	49	5.2	8	23	9	6	3
19	2	.2	....	....	2	....	....
20	3	.3	....	....	3	....	....
21	8	.9	1	3	3	1	....
22	17	1.9	....	8	8	....	1
23	80	8.6	17	26	13	17	7
24	22	2.3	1	11	10	....	....
25	36	3.9	1	14	16	5	....
26	2	.2	....	2	....	....	....
27	28	3.0	....	6	22	5	....
28	13	1.3	....	4	9	....	....
29	52	5.6	5	22	20	4	1
30	45	4.9	1	17	14	12	....
31	14	1.5	....	11	3	....	....
32	....	....	....	....	....	....	....
33	....	....	....	....	....	....	....
34	7	.8	....	2	5	....	....
35	....	....	....	....	....	....	....
36	3	.3	....	1	2	....	....
37	1	.1	....	....	1	....	....
Other	93	10.0	4	17	59	9	4
TOTAL	933	100.0	93	346	353	112	29

N. V. — mode of transportation not verified

Figure 1: Sample of the information sheet filled out by patients in this study.

Name ____________________ Record Number ________
Birth Date ________ Race ________ Marital Status ________
Present Address ____________________ Zip Code ________
How long have you lived at this address? ________ years ________ months
Previous Address ________ How long did you live there? ____ yrs. ____ mos.
How did you come to the clinic today?
Taxi ______ Bus ______ Automobile ______ Walk ______ Other ______
How do you intend to come to this clinic in the future?
Taxi ______ Bus ______ Automobile ______ Walk ______ Other ______
Do any members of your family come to this clinic? Yes ____ No ____
If yes, who? ____________________
Have you ever had any dental treatment before? Yes ______ No ______
If yes, when? ____________________
where? ____________________
what type? Emergency care ________ Regular dental care ________
Number of visits to dentist: 1 ________ 2 ________ 3 or more ________
Why did you come to this clinic? ____________________
What type of dental care would you like to receive here? ________

FIGURE 2 LOCAL POSTAL ZONES FOR METROPOLITAN BALTIMORE. UNIVERSITY OF MARYLAND SCHOOL OF DENTISTRY, LOCATED IN ZONE 1, AT POINT "X".

Dental Arch Dimensions In Children of Varying Chippewa Indian Ancestry

John M. Grewe, D.D.S., Ph.D.

Dental Arch Dimensions In Children of Varying Chippewa Indian Ancestry

by

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Summary

Anterior arch widths in children of Chippewa Indian ancestry in both males and females increase with age until the permanent canines have completely erupted. A greater increase is observed in the maxilla. Thereafter the dimension remains approximately the same or decreases slightly. Posterior arch width increases with age in both sexes until a maximum is obtained; at approximately the same time the permanent second molars have completed eruption. Maximum sagittal arch length in both sexes was observed prior to the completed eruption of the permanent first molars.

There is a statistically significant race variability in anterior arch width between Caucasians and Chippewa Indians. Although this racial variability was not as obvious between the two groups of children with varying percentages of Indian ancestry.

Introduction

The predominant morphological pattern of dentofacial deviations usually observed in a population is that of a tooth size — arch length, non skeletal discrepancy. This problem, fortunately, lends itself to more successful interceptive and corrective measures as compared to correction of a skeletal discrepancy. To accomplish the interceptive and/or corrective measures a number of biological principles need to be understood. Dental arch variability is one of the most essential. Longitudinal and cross-sectional studies of dental arch variability has been reported for North American Caucasian populations (Knott, 1961; Mills, 1966; Moorrees, 1959; Sillman, 1964). Studies have also been reported on different racial populations such as the Aleuts (Moorrees, 1957), Chinese (Hong, 1965), Aborigines (Barrett, Brown, and MacDonald, 1965), and Swedes (Seipel, 1946). No reports have been published on dental arch variability in American Indians. Also, there appears to be no reports on the influence of varying the percentage of ancestry of a major racial group.

The present cross-sectional study is concerned with determining and analyzing dimensional changes that occur in the maxillary and mandibular arches of Chippewa Indian children with a varying percentage of Indian ancestry.

Materials and Methods

The state of oral health was surveyed in 651 children ranging from 6 to 18 years of age, who were enrolled in four Red Lake Indian Reservation public schools. Occlusal, periodontal, caries and oral hygiene indices were obtained. Oral congenital malformations, body height and weight were also recorded for each child. After the clinical examination a bees' wax impression of centric occlusion was obtained. The wax impressions were coded, poured in stone, and trimmed so that accurate anterior-posterior orientation of the maxillary and mandibular cast would be possible following the removal of the bees' wax.

The measurements were obtained directly from the models using a sliding vernier caliper calibrated to the nearest tenth of a millimeter. Three measurements, the anterior and posterior arch width and sagittal arch length, were taken on each cast. The anterior arch width was determined by measuring the distance from the canine cusp tip, or from the center of a wear facet if present, on one side to its antimere. The posterior arch width was determined by measuring the distance between the mesio-lingual cusp tips of the maxillary first molars and between the mesio-buccal cups tips of the mandibular first molars. Sagittal arch length was determined by measuring in the midline from an anterior limit, which was a point on a line tangent to the incisal edge of the central incisors, to the posterior limit which was a point on a line from the distal surface of the second primary molars or permanent second premolars.

Results

The results obtained for arch length and arch width measurements are presented according to the dental arch, age, sex and per cent of Indian ancestry in Tables I - IV. Children with unknown percentage of Indian ancestry and children with 50-75 per cent Indian ancestry are not presented. This information may be obtained from the author.

Anterior arch width — In the maxilla the mean minimum anterior arch width was observed in both sexes at the earliest age. This increased over 7 mm in the male and 6 mm in the female. The mean maximum was observed at age 13 in both sexes. Minimal decrease was observed thereafter. In the mandible the mean minimum for both sexes was at the earliest age. The mean maximum was observed at age 8 in females and 9 in males. In the female this dimension remained constant thereafter whereas in the male this dimension decreased approximately 1 mm.

Posterior arch width — in the maxilla posterior arch width increased approximately 3 mm in the males and 2 mm in the females from the early ages to age 13. Both sexes lost approximatley 1 mm between 13 to 17. In the mandible posterior arch widths increased in both sexes from age 6 to 12. Thereafter the dimension remained rather constant.

Sagittal arch length — Sagittal arch length in the maxilla in the total population studied obtained a mean maximum at age 11 in the females and age 12 in the males. In both sexes the 3-4 mm temporary arch length gain observed from ages 6 to 11 or 12 is lost by

age 17. The mean maximum sagittal arch length in the mandible was observed at age 7 in the males and age 6 in the females. Both sexes loose approximately 3-4 mm in arch length from age 6 to 17.

Racial variability — In order to determine the influence of ancestry, comparisons were made between the 0-50 per cent Indian ancestry group, 75-100 per cent Indian ancestry group and data obtained by Moorrees on Caucasians.[3] Because of the different landmarks on the casts only the anterior arch width was compared with Moorrees' study. Maxillary anterior arch width in the two Indian groups and in both males and females were observed not to be significantly different. Mandibular anterior arch width between the two Indian groups in females was also not significantly different. However, in the males there was a significant difference between anterior arch width and percentage of Indian ancestry (P=.01). Also the anterior arch width in the 75-100 per cent Indian ancestry group was observed to be significantly greater than Moorrees' Caucasian Group in both males and females (P=.01).

In posterior arch width an increased dimension was observed in females in the 75-100 per cent Indian ancestry group in both the maxillary and mandibular arches. With exception of ages 6 and 14 in the maxilla, and 6, 7, 14, and 16 in the mandible, the posterior arch width was greater by one millimeter in the children with the greater Indian ancestry; although this was not statistically significant. In males no differences were observed in the mandibular arch. An increase was observed in the maxillary arch dimension as the percentage of Indian ancestry increased; but not as pronounced or as consistent as in the females.

Discussion

Dental arch dimensional changes and the associated dental morphology are important in diagnosis and treatment of incipient malocclusions. If the patterns of dimensional changes are known and dental morphology is understood an estimate of the resulting occlusion may be made. There are methods available today to aid a dentist in making these types of decisions. Considering these methods were devised on and for Caucasians the question of applicability on other racial populations was raised. The results presented in this paper indicate that the patterns of change are similar regardless of the major racial type. There are, however, absolute differences in magnitude and timing. Anterior arch width differences is an excellent example. The next logical step will be to evaluate the tooth size in these children with a varying percentage of Chippewa ancestry. Practically, this information, coupled with the present knowledge will provide more insight on when to use or not use a specific occlusal guidance procedure on different populations.

Regardless of the findings of this project the experimental model, technique and advantages accruing from this type of epidemiological survey should be considered. The model is that of determining the racial ancestry and its influence on specific physical characteristics of mixed population existing within the same environment. The major problems in this type of model are that of accuracy of ancestrial background and sample size.

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Table I

Mandibular Arch Measurements for Children With 0-50 Percent Indian Ancestry

Age in Years	*Sex*	*Anterior Arch Width (MM)*	*S.D.*	*S.E.*	*Posterior Arch Width (MM)*	*S.D.*	*S.E.*	*Sagittal Arch Length (MM)*	*S.D.*	*S.E.*
6	Female	24.89	1.64	0.54	44.51	1.83	0.75	26.71	1.50	0.53
	Male	25.19	3.37	1.27	45.33	3.64	1.37	25.77	1.89	0.71
7	Female	26.45	2.21	0.70	44.35	2.40	0.85	26.44	2.17	0.68
	Male	26.77	2.14	0.80	45.92	2.63	0.99	26.76	1.71	0.71
8	Female	27.86	1.70	0.85	43.34	1.39	0.69	25.85	1.88	0.94
	Male	27.69	1.31	0.43	46.44	1.46	0.48	26.35	2.28	0.64
9	Female	26.07	1.71	0.64	44.20	2.86	1.08	25.63	1.68	0.63
	Male	29.35	0.70	0.31	44.93	1.80	0.80	26.73	2.60	0.76
10	Female	27.64	2.34	0.88	43.63	1.98	0.75	24.64	2.26	0.85
	Male	28.45	2.73	0.86	48.03	2.08	0.65	26.24	2.08	1.16
11	Female	27.02	1.19	0.48	43.84	2.06	0.84	24.68	1.64	0.66
	Male	27.69	1.54	0.88	46.35	2.60	1.50	25.04	0.56	0.66
12	Female	27.48	1.71	0.60	44.85	3.12	1.10	24.60	1.97	0.69
	Male	28.25	2.15	0.64	47.25	2.32	0.70	25.43	2.01	0.32
13	Female	27.22	3.17	1.12	44.24	2.78	0.98	23.96	0.93	0.32
	Male	28.15	1.62	0.51	48.06	3.83	1.21	25.75	2.02	0.60
14	Female	27.43	1.44	0.43	46.89	2.40	0.72	23.80	1.35	0.40
	Male	27.68	1.02	0.42	47.53	1.92	0.78	24.35	2.19	0.64
15	Female	26.41	2.00	0.51	44.48	2.73	0.70	23.09	1.38	0.35
	Male	28.65	1.88	0.59	48.24	2.32	0.73	24.94	2.28	0.89
16	Female	29.08	1.26	0.63	47.12	3.59	1.79	26.56	0.95	0.47
	Male	28.14	2.80	0.88	48.44	2.40	0.76	22.93	1.93	0.72
17	Female	26.61	1.85	0.39	45.03	3.00	0.67	24.05	2.47	0.55
	Male	26.97	1.77	0.44	45.59	3.57	0.89	23.47	1.41	0.61

Table II

Maxillary Arch Measurements for Children With 0-50% Indian Ancestry

Age in Years	*Sex*	*Anterior Arch Width (MM)*	*S.D.*	*S.E.*	*Posterior Arch Width (MM)*	*S.D.*	*S.E.*	*Sagittal Arch Length (MM)*	*S.D.*	*S.E.*
6	Female	30.67	1.80	0.60	39.86	3.15	1.28	29.08	1.99	0.70
	Male	30.34	2.08	0.78	38.76	2.63	0.99	28.78	1.26	0.47
7	Female	31.85	3.50	1.10	37.97	6.26	2.21	29.24	2.90	0.91
	Male	32.48	3.42	1.29	40.33	2.76	1.12	30.05	2.93	1.10
8	Female	32.84	2.05	1.02	38.60	0.50	0.25	29.83	2.62	1.31
	Male	33.91	2.30	0.76	42.45	1.76	0.58	30.34	2.05	0.68
9	Female	33.07	2.68	1.01	39.48	2.81	1.06	29.64	1.69	0.64
	Male	34.35	2.64	1.18	41.36	1.57	0.70	31.72	1.15	0.51
10	Female	33.48	2.10	0.79	39.48	2.11	0.79	30.04	1.71	0.64
	Male	35.84	3.50	1.10	42.74	2.26	0.71	31.55	1.46	0.46
11	Female	33.86	1.14	0.71	40.01	1.94	0.79	31.01	1.84	0.75
	Male	36.01	0.55	0.32	43.68	2.32	1.34	33.00	0.59	0.34
12	Female	34.46	2.94	1.04	39.59	5.67	2.00	30.23	3.17	1.12
	Male	36.98	2.09	0.62	44.26	2.02	0.61	32.61	2.64	0.79
13	Female	34.58	2.30	0.81	40.35	1.93	0.68	28.48	0.99	0.35
	Male	36.94	2.12	0.67	43.53	2.93	0.92	31.25	0.86	0.27
14	Female	35.34	2.10	0.63	42.54	1.40	0.42	28.43	1.74	0.52
	Male	34.51	2.32	0.94	43.35	4.07	1.66	29.18	2.72	1.13
15	Female	33.81	2.01	0.52	39.34	4.10	1.05	28.67	2.68	0.69
	Male	36.65	1.83	0.58	41.94	4.15	1.21	30.43	1.58	0.50
16	Female	35.13	1.25	0.62	40.58	1.47	0.73	29.85	0.56	0.28
	Male	37.05	3.47	1.09	43.96	3.01	0.95	29.45	3.60	1.14
17	Female	33.90	1.32	0.28	37.85	3.05	0.68	27.83	3.13	0.70
	Male	35.10	1.99	0.49	41.24	2.85	0.71	27.60	1.91	0.47

Table III

Mandibular Arch Measurements for Children With 75-100% Indian Ancestry

Age in Years	*Sex*	*Anterior Arch Width (MM)*	*S.D.*	*S.E.*	*Posterior Arch Width (MM)*	*S.D.*	*S.E.*	*Sagittal Arch Length (MM)*	*S.D.*	*S.E.*
6	Female	25.76	1.88	0.71	42.98	7.05	2.49	26.60	2.12	0.75
	Male	26.61	2.68	1.01	45.06	3.29	1.24	24.50	1.75	0.66
7	Female	27.10	1.71	0.41	44.93	2.81	0.68	26.28	1.55	0.37
	Male	27.15	3.15	0.78	46.53	2.92	0.75	26.64	2.11	0.51
8	Female	28.36	2.04	0.64	45.73	2.31	0.73	25.94	2.45	0.77
	Male	29.46	3.92	1.30	46.13	3.20	1.06	26.78	2.94	0.98
9	Female	28.66	2.18	0.56	46.27	2.08	0.55	26.60	3.00	0.77
	Male	29.12	1.63	0.54	47.46	1.81	0.60	25.79	1.65	0.55
10	Female	28.08	1.47	0.42	47.09	3.36	0.97	26.85	3.18	0.92
	Male	29.00	1.14	0.33	47.92	3.14	0.84	26.10	2.43	0.67
11	Female	28.47	2.55	0.80	48.04	3.78	1.19	25.54	1.75	0.55
	Male	28.35	1.40	0.53	48.76	2.28	0.86	25.92	2.57	0.97
12	Female	27.35	2.98	0.89	45.88	3.87	1.16	23.88	1.74	0.52
	Male	29.41	2.41	0.59	46.05	3.35	0.81	25.93	2.02	0.49
13	Female	28.33	1.49	0.52	47.85	3.12	1.10	23.47	1.42	0.50
	Male	29.22	1.83	0.43	47.96	2.73	0.64	24.07	1.59	0.37
14	Female	27.72	2.33	0.64	46.74	2.14	0.59	23.56	1.90	0.52
	Male	29.35	2.69	0.77	48.26	3.22	0.93	25.83	3.75	1.08
15	Female	31.33	7.08	5.01	46.35	2.81	1.99	23.71	2.35	0.78
	Male	29.71	3.37	1.01	47.16	2.51	0.75	24.34	2.68	0.80
16	Female	27.36	1.27	0.48	46.76	1.91	0.72	24.62	1.77	0.67
	Male	29.05	2.61	0.98	49.06	2.96	1.11	23.76	1.38	0.52
17	Female	27.94	2.06	0.92	46.75	2.31	1.03	23.55	2.15	0.96
	Male	27.86	1.76	0.88	47.08	2.72	1.36	24.07	1.71	0.85

Table IV

Maxillary Arch Measurements for Children With 75-100% Indian Ancestry

Age in Years	*Sex*	*Anterior Arch Width (MM)*	*S.D.*	*S.E.*	*Posterior Arch Width (MM)*	*S.D.*	*S.E.*	*Sagittal Arch Length (MM)*	*S.D.*	*S.E.*
6	Female	31.47	1.72	0.60	39.22	1.88	0.66	27.98	2.12	0.75
	Male	32.20	2.11	0.80	40.20	1.94	0.79	28.48	2.17	0.82
7	Female	32.45	1.96	0.47	40.40	2.10	0.51	29.41	1.87	0.45
	Male	32.22	2.65	0.64	42.59	3.47	0.86	29.16	2.47	0.60
8	Female	33.95	3.35	1.06	40.56	2.24	0.70	28.45	2.32	0.73
	Male	33.35	3.61	1.20	40.95	2.92	0.97	29.24	3.19	1.06
9	Female	35.01	1.98	0.51	41.14	2.21	0.57	30.68	2.56	0.66
	Male	36.79	1.66	0.55	44.34	1.98	0.66	31.46	1.60	0.53
10	Female	35.08	1.54	0.44	41.59	2.10	0.60	30.09	1.05	0.30
	Male	35.79	2.19	0.58	43.55	2.38	0.63	31.05	2.00	0.53
11	Female	36.05	3.13	0.99	42.45	3.17	1.00	30.05	1.77	0.56
	Male	35.92	1.89	0.71	43.76	1.28	0.48	30.05	2.49	0.94
12	Female	35.61	2.68	0.80	41.44	2.69	0.81	30.17	2.41	0.72
	Male	36.82	3.32	0.80	42.47	3.33	0.80	31.16	2.85	0.69
13	Female	36.48	1.72	0.61	42.92	2.75	1.04	29.59	2.23	0.78
	Male	38.24	1.23	0.29	44.39	2.64	0.62	29.90	2.00	0.47
14	Female	35.87	2.36	0.65	42.48	2.26	0.62	28.89	2.70	0.76
	Male	37.52	2.57	0.74	43.93	2.30	0.66	30.02	2.76	0.79
15	Female	35.31	3.24	1.08	42.05	2.64	0.88	28.82	0.68	0.48
	Male	37.44	3.88	1.22	43.44	1.96	0.62	29.66	2.54	0.80
16	Female	34.75	1.62	0.61	41.63	2.12	0.80	28.79	0.98	0.37
	Male	37.06	3.40	1.28	43.93	2.37	0.89	31.62	8.35	3.15
17	Female	34.97	1.14	0.51	42.15	1.10	0.49	28.16	2.57	1.15
	Male	37.35	3.35	1.67	43.60	2.35	1.17	29.33	1.15	0.57

Format Recommendations For Contributors

I. General Information

Two complete manuscripts with illustrations should be sent to the Editor, Journal, Baltimore College of Dental Surgery, University of Maryland School of Dentistry, Baltimore, Maryland, 21201. The articles which are submitted for publication are expected to follow the format suggested below. It is assumed that the papers are based on original data and that they have not been published or previously submitted for publication in other Journals.

II. Text Sections

Each article should be sequentially arranged as follows:

A. Summary
B. Introduction
C. Materials and Methods
D. Results
E. Discussion
F. Acknowledgements
G. References

III. Text References

References cited in the text should include the author(s) last name and publication year as in "Doe and Brown (1966)". Multiple authorship (more than 2) is initially cited *in toto*. e.g. Doe, Brown and White (1966). Subsequent reference to the multiple authorship (more than 2) should be made as: Doe, *et al.*, (1966).

IV. Bibliographic Reference

A. References cited bibliographically should be alphabetically and sequentially arranged as follows: author(s), year, article, title, Journal (Index Medicus preferred), volume and complete page coverage. Example:

Does, J. J., Brown, D. M. and White, S. T. 1966. Fibrillogenesis in the dental sac. **The Journal** *21* 55-63.

B. Author(s) having two or more publications in a given year should be designated as *a*, *b*, etc. Examples:

Doe, S. S. and Brown, D. M. 1966*a*. Heterochromatin in oral epithlial cells. **The Journal** *20:* 73-85.
sac. **The Journal** *21:* 55-63.

——— 1966*b*. Cytochemical features of oral epithelium. **The Journal** *20:* 98-110.

C. Book or monograph citations are arranged as:

Doe, S. S. and Brown, D. M. 1966. Inheritance and Development (Edited by White, S. T.) Chapt. 1, p. 16. University Press, Baltimore.

D. References which are in press or are personal communications are given as follows:

Doe, J. J. 1966. Fibrillogenesis in the dental sac. **The Journal** (in press).

Brown, D. M. 1966. (personal communication).

V. Illustrations, Legends and Tables

A. All illustrative material excluding tables should be indicated as figures. (Fig. 0), and submitted as mounted glossy prints. The illustrations singly or grouped should not exceed 5″ x 7″. Labels, lead lines, arrows or other designations should be indicated on the print and each illustration should be numbered consecutively. The back of the illustration should bear the following information:

Figure number
Author(s)
Reference to top of illustration

B. Legends should be brief and should not duplicate text material. Pertinent information including label explanation, technical data such as stains, etc., and magnification should be given.

C. Tables should be typed on separate sheets and should be identified by a Roman numeral and appropriate title. Headings as well as explanations should be concise.

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CONTENTS

Comparability of A Dental School Clinic Population to National Survey Data: Elderly Patients

STEWART SHAPIRO, D.M.D., M. Sc. H.

J. Baltimore Coll. Dent. Surg. 26(1) 1971

Comparability of A Dental School Clinic Population to National Survey Data: Elderly Patients

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SUMMARY

A previous study was completed describing the prospective clinic patient at the University of Maryland, School of Dentistry, Dental Clinic.[1] The study reported the distribution of patients by age, race, sex, place of residence, and method of access to the clinic. The population studied permits a response to the question of lack of interest or motivation on the part of the elderly in seeking dental care. This report presents data which is similar to findings of the National Health Interview Survey (1960-62). [2 3] Approximately 12% of the population sampled at the University Dental Clinic were above 55 years of age. That segment of the study population reported employment of public transportation more than 50% of the time to come to the clinic for their appointments. The primary dental treatment demand was for complete denture prostheses.

INTRODUCTION

The need for dental care of the elderly is difficult to measure. Most dental public health programs are directed at the pediatric and/or adolescent population, where the apparent need for preventive measures masks the apparently less obvious needs of the elderly. Although the medical needs of that increasing segment of the population are given more adequate financial consideration, the available dental monies are indeed meager.

There is a sincere interest and desire for dental care by the aging. A consistent percentage of that segment of the population will seek available dental care. This report also describes the dental needs (determined by demand for care as opposed to professional interpretation of needs), modes of transportation utilized to obtain dental treatment, and patient rationale for selection of a clinic for their dental services.

METHODOLOGY

A questionnaire was designed to accumulate data which would provide a profile of individuals seeking dental care at the University of Maryland School of Dentistry. A review of annual patient admission application records was completed in a previous study.[1] It revealed that approximately 5,000 patients per year applied for admission to the clinic for dental care. The ini-

tial study to obtain demographic information such as age, race, sex, marital status, place of residence, modes of transportation used to come to the clinic, and type of dental care desired was completed during the period January 1, 1970 to May 31, 1970. A 33 percent random sample of people were interviewed and complete data was obtained for 933 individuals. The initial report described the entire sample population. This report describes only one segment of that population, those individuals above 55 years of age.

RESULTS

Information was obtained from 115 people who ranged from 55 to 87 years of age, comprising 12% of the total sample population. The mean age for the 115 subjects was 63.59 years, with a standard deviation of 7.10 years. There were only four individuals 79 years or older. The racial distribution was skewed slightly toward whites who represented 54% of the total, in contrast to 46% for the non-whites. The male-female ratio was almost 1: 1, with females representing 51% of the sample. For both race and sex, there was relatively equal distribution at each three year age interval, starting with 55 years of age.

The reasons expressed for selecting the clinic for dental care were ranked by the respondents as follows: (1) economy - cost (2) quality of care, and (3) referral by a friend.

The type of dental care requested was reflective of the age group. A request for dentures was made by 44% of the individuals; the request for extractions to be followed by denture construction was made by 16%; extraction only requests (single tooth or more) by 14%; request for general dental work by 18%; and only 8% did not specify their dental needs, that is, "can my teeth be saved?"

Public transportation was employed by 44% of the individuals with taxi-cab users comprising an additional 9%, totaling 53% using other than private transportation. It was notable that 12% reported they walked to the clinic. The remainder (35%) arrived by private automobile, either driving by themselves or being driven by others.

DISCUSSION

Previous surveys have presented data related to the frequency of dental visits by various age groups. The age group 65 years and older is reported to represent only 9% of the total number of dental visits per person per year.[3] The results of this survey confirm this low percentage. However, since this report is concerned with only an isolated diagnostic visit, it cannot be interpreted as indicative of an overall visit projection. It does, however, demonstrate a **desire** for dental care since 12% of the sample population were age 55 and above; (age 55-64 represented 3%, and 65 or older represented 9%). This is in agreement with the data presented at the national level. It is estimated that approximately 60% of the population aged 65 years and over are edentulous and in need of dentures. [3 5] These estimates were based on the National Health Interview Survey covering the period 1957-1958. This report is in essential agreement with those esti-

mates, as 44% of our sample were edentulous and an additional 14% desired extraction of their remaining teeth and subsequent construction of dentures. As in the National Health Survey, this older segment of our sample was typically retired, unable to work, and economically less able to obtain dental care.

Oral health needs in the National estimate were 42% for denture work, 17% for extractions and dentures and 20% for general restorative procedures. This sample group exhibited corresponding percentages of 44% for denture work, 18% for extractions and dentures, and 18% for general restorative work.

CONCLUSIONS

The following conclusions can be defined from this study:

1. The elderly segment of the sample investigated during a previous study seeking dental care at the University of Maryland School of Dentistry exhibits a similar distribution of over-all patient frequencies by age as the National Health Interview Survey of 1960-62. Approximately 12% of patients seeking dental care are above 55 years old.
2. This analysis suggests that the dental demands of this sample are similar to those of the general National population. Therefore, representative data relative to the dental problems and behavioral motives for seeking dental care associated with the elderly might be obtained through further investigation of this dental school's population.
3. Complete prostheses and/or multiple extractions are apparently the main priorities for this segment of the population, as determined by the patient's descriptions and demand for type of dental care.

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Photoelectric Densitometry of the Circulation of the Human Dental Pulp

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Photoelectric Densitometry of the Circulation of the Human Dental Pulp

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SUMMARY

The technique of photoelectric densitometry has been utilized in the detection of pulpal circulation of an intact human tooth. The pulsatile blood flow in the dental pulp produced changes in the optical density of the tooth. A beam of light passing through the tooth was affected by the pulsatile changes in phototransmittance; this attenuated light beam falling upon a photoconductive cell mounted opposite the light source produced a minute signal which was amplified and recorded.

The recorded pulsations were synchronous with the electrocardiogram and demonstrated the systolic and diastolic phases of the cardiac cycle. A dicrotic notch was also demonstrated in the downward stroke of the recordings.

A non-traumatic technique for the study of the circulatory physiology has been presented. The detection of pulpal circulation was accomplished and the detection of possible changes due to varying the environment of the tooth were explored.

INTRODUCTION

A new physical dynamic approach to the study of circulation of the intact human tooth was implemented by photoelectric densitometry of the tooth. The changes in phototransmittance of a tooth due to pulsatile blood flow in the pulp chamber caused changes in the electrical resistance of a photoconductive cell Burnette, and Horn (1963); Eldrup-Jorgenson, Schwartz, and Wallace (1966); Upthegrove and Dorman (1966).

Previous difficulties were encountered in studies of pulpal physiology because of:

1. the physical barrier of the hard structure of the tooth,

2. the difficulty of observing and recording the pulpal circulation without damaging the pulpal tissues, and
3. the minute volume of blood (0.0004 ml. in the central incisor to 0.0414 ml. in the cuspid tooth of a dog) contained in the pulpal vessels Neidle and Liebman (1964).

The non-traumatic method of photoelectric densitometry was used to develop a technique:

1. for the detection of pulpal circulation, and
2. to be used in continuous evaluation of the circulation in an intact human tooth.

MATERIALS AND METHODS

An appliance was designed to incorporate the light source and the photoconductive cell to be carried to the tooth. Many problems were encountered in developing an appliance. As each problem of the prototype was solved, an appliance was designed which would provide the following requisite conditions:

1. close adaptation to the tooth to be studied,
2. an opaque surface to eliminate all external light,
3. retention and stability to prevent distortion of the signal by changing the distance and angle of the light path through the tooth, and
4. ease in construction necessary for the study of several teeth in several patients.

A cross-section of the present appliance and tooth to be observed appears in Figure 1.

The basic acrylic appliance was custom-made for each dental arch to be tested (A). A small, unfiltered incandescent light bulb (B) was securely attached to the appliance on the labial of the tooth to be tested and a photoconductive cell (E) was mounted opposite the light source on the lingual of the tooth. "Thiokol" rubber was used to opaque the appliance to prevent any extraneous light from affecting the photoconductive cell. The rubber was also utilized to provide retention and stability of the appliance. The electrical connections were insulated and the signals carried through a shielded cable (D) to the extra-oral instruments.

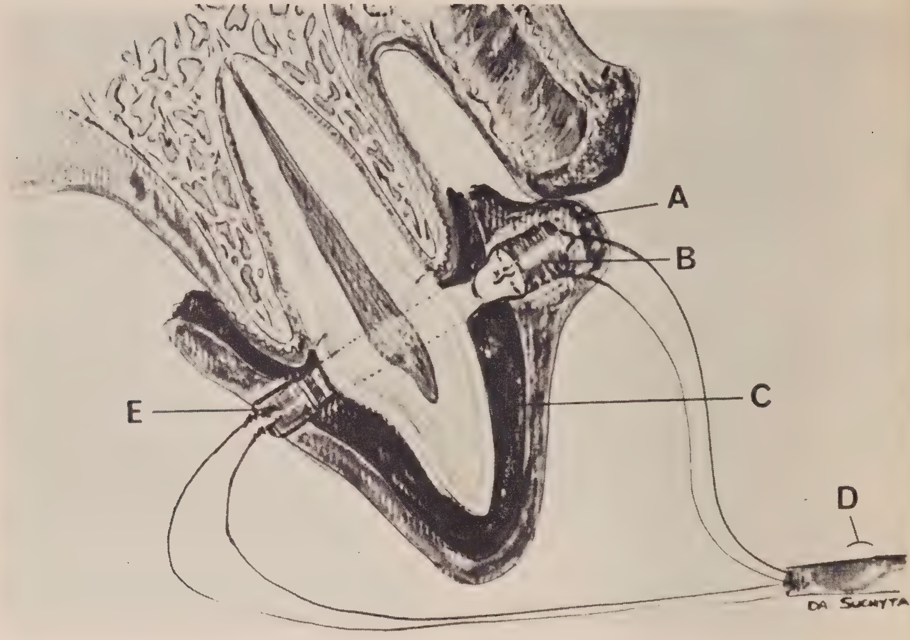
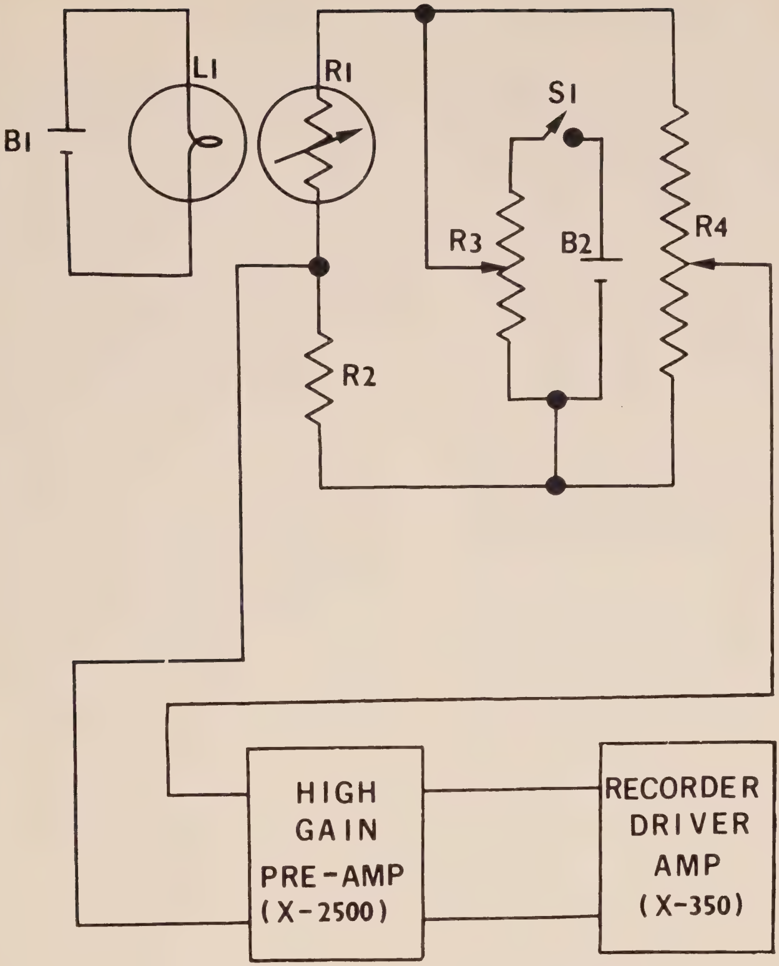


FIGURE 1

Diagram of photoconductive intra-oral appliance used in the present study. (A) acrylic base. (B) light source. (C) "Thiokol" rubber. (D) shielded cable. (E) photoconductive cell.

The resistance of the photoconductive cell decreases as the light level increases, and increases as the light level decreases. This varying resistance can best be measured by employing the photoconductive cell as the variable arm of a Wheatstone bridge. Therefore, one can obtain an accurate signal which is inversely proportional to the amount of illumination upon the surface of the photoconductive cell Camishion (1964).

A schematic circuit diagram of the bridge is illustrated in Figure 2. The light source (L1) chosen for the intra-oral appliance was a G. E. pre-focused incandescent bulb. The lamp was powered by a 1.5 volt dry-cell battery (B1). The cadmium, selenide photoconductive cell (R1) in the bridge circuit was a CL 904L Clairex cell. The other resistors in the bridge were a 5000 ohm 1 per cent precision fixed resistor (R2), and a potentiometer (R4). This potentiometer (R4), a 20,000 ohm 10-turn helipot, was used in this circuit to provide a null bridge balance adjustment. The bridge excitation source was a 12-volt battery (B2). Its voltage to the bridge input was controlled by a 20,000 ohm 10-turn helipot (R3). This potentiometer (R3) was used as a variable gain control. The low



BRIDGE CIRCUIT DIAGRAM

FIGURE 2

level signals from the bridge were amplified by a high-gain preamplifier, and recorded on a Physiograph Six Recorder (E & M Instrument Company, Inc., Houston, Texas).

Ten male subjects (all in apparent good health), ages 24 to 32, were selected from among the University of Detroit dental students. Each subject was given the standard health questionnaire and was also required to sign a Voluntary Participation Form.

Impressions were made of the maxillary arch of each subject and models were made from these im-

pressions. The custom appliance was constructed on the models. A maxillary central incisor without restorations or excessive destruction due to trauma was selected. The photoconductive cell and light were mounted in the appliance on the lingual and labial sides of the tooth, respectively. The individual appliance was adjusted in the mouth of each subject and the "Thiokol" rubber was added. Small openings through which the light was to pass were provided in the rubber.

Electrocardiagram and respiration were also recorded for each subject. Each subject was given the tests in the exact order as presented below:

I. Five of the subjects were selected for initial testing in order to determine whether or not pulpal circulation could be detected, and the same procedure was repeated on three consecutive days.

II. The ten subjects were tested for:

A. The detection of pulpal circulation with the device described above.

B. The possibility of change in circulation due to:

1. a change in postural position by recording with the subject reclining,
2. a change in the external temperature of the tooth, and
3. a local infiltration-type injection of Lidocaine Hydrochloride 2%, 1/100,000 epinephrine.

Each tooth was given sufficient time to return to normal between each test.

The subjects were comfortably seated with the intraoral photoconductive cell appliance secured in position. The electrocardiogram electrodes were attached in the Lead One arrangement. The bellows-type pneumograph was placed around the subjects' chests to record the respiration. The base lines were adjusted on the recorder for these three parameters.

Recordings were then made of these parameters with the patients seated. The subjects were then asked to recline and four recordings were made for each parameter immediately, and at five-minute intervals. The subjects were then raised to a sitting position and, again, four recordings were made for each parameter immediately, and at five-minute intervals.

The possibility of a change in circulation due to variations in the external temperature of the tooth was tested. The amount of temperature change was a critical factor because, in this study, neither could trauma be used, nor could the tooth be sacrificed. Therefore, the temperature changes had to be within physiological limits of the tooth. It was evident that the usual means of changing the external temperature could have been too severe. It was decided that, to vary the temperature, the tooth would be bathed in a liquid that was within the physiological limits of the tissues of the mouth. Hot coffee and soft ice cream were used to change the external temperatures. The temperature changes were accomplished by the use of the coffee and ice cream over a period of 4 to 5 minutes.

The appliance was removed while the tooth was being subjected to temperature changes. Then the ap-

pliance was inserted and four recordings were made immediately, and at five-minute intervals to detect any possible change due to the external temperatures.

The last test measured the effect of local infiltration-type injection at the apex of the tooth to be tested of Lidocaine Hydrochloride 2%, 1/1,000,000 epinephrine on pulpal circulation. Recordings were made immediately following injection, at the specified five-minute intervals.

RESULTS

The results of preliminary testing of the appliance, opaquer, and light source are shown in figures 3 and 4. The basic acrylic appliance without the opaquer was placed over the tooth to be tested. The first record in Figure 3 demonstrated that regular pulsations were recorded. However, it was im possible to determine whether or not the resultant recording was of pulpal circulation or of other periodontal tissues because:

1. the direction and amount of light were not restricted to the intra-oral light source, and
2. the passage of the light was not restricted to the tooth and could have passed through the periodontal tissues as well as the hard structure of the tooth.

The center recording in Figure 3 demonstrated the effect of the opaquer which eliminated the pulsations, thus proving that all extraneous light was eliminated.

The last recording in Figure 3 was made after the openings were made in the opaquing material to restrict the passage of the light only through the tooth; this is representative of the recorded pulsations of the pulpal circulation.

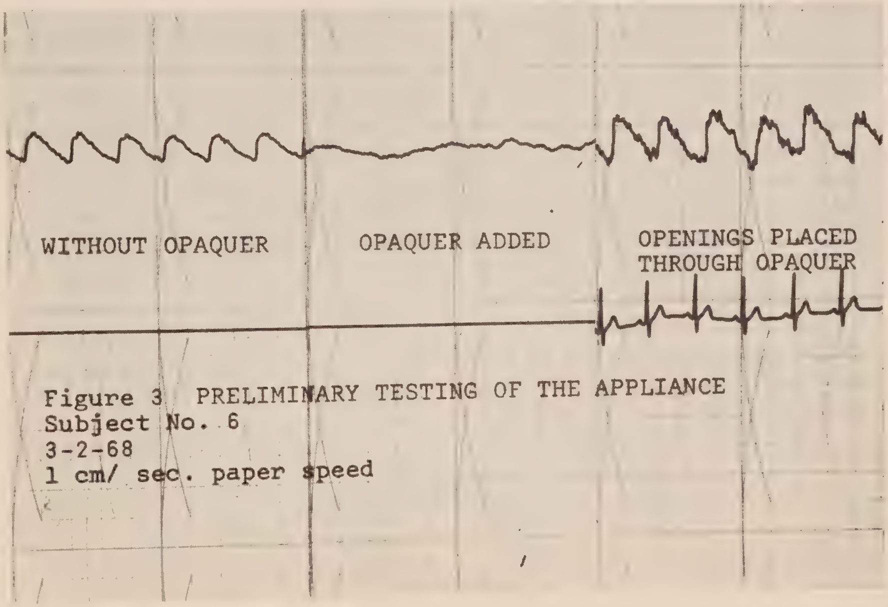


Figure 3 PRELIMINARY TESTING OF THE APPLIANCE
Subject No. 6
3-2-68
1 cm/ sec. paper speed

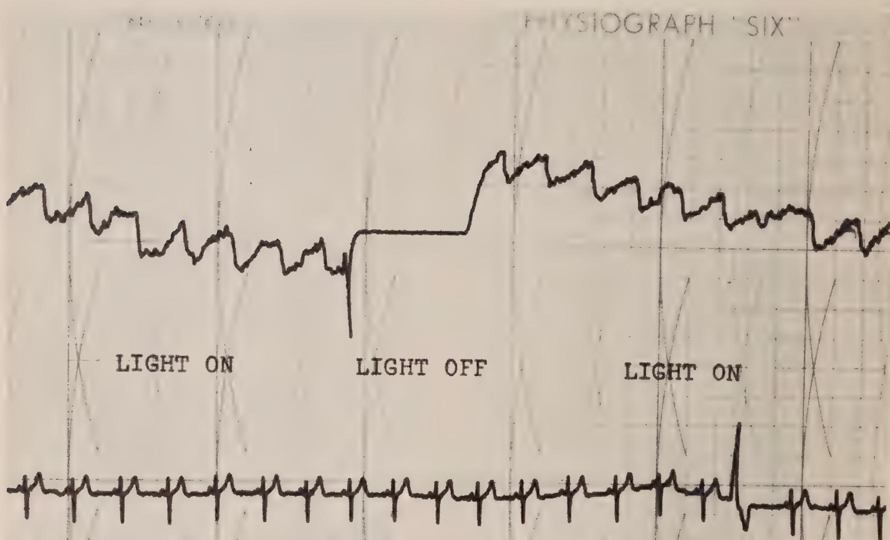


Figure 4. TEST OF INTRA-ORAL LIGHT
Subject No. 8
4-11-68
1 cm/sec. paper speed

The recording in Figure 4 demonstrated the effect of turning off the intra-oral light source for three seconds, and then turning it on again for the resumption of recorded pulsations.

The recordings showed definite rhythmic changes in the optical density of the tooth, these changes being produced by the pulsatile pulpal circulation. The pulsations were synchronous with the electrocardiogram. Another recording, Figure 5, displayed the rapid increase in optical density, which rose to a peak. The increase corresponded to the rapid influx of blood as a result of systole, and the decrease in optical density began with the down stroke of the recording pen. This was the diastolic phase of the cardiac cycle. The notch in the downward stroke was the result of a small oscillation on this falling phase of the pulse wave due to vibrations set up when the aortic valve snapped shut, the dicrotic notch.

The recordings made on three consecutive days or three different sessions during one day showed that the detection of pulpal circulation could be reproduced readily. The amplitude and character of fluctuations did vary from test to test, and it was not possible to achieve consistent results with this instrumentation. Representative records of the results of each type of test are presented in Figure 6.

These records were compiled from the tests of subjects 3 and 4.

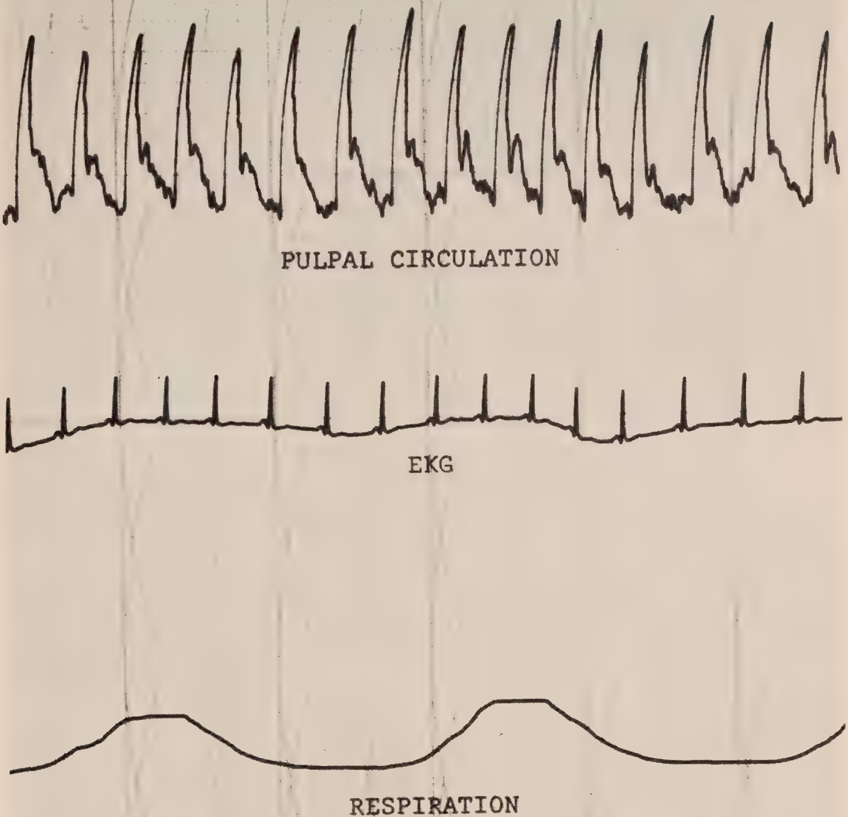


Figure 5 RECORDING OF PULPAL CIRCULATION, EKG, AND RESPIRATION

Subject No. 4
3-5-68
1 cm/sec. paper speed

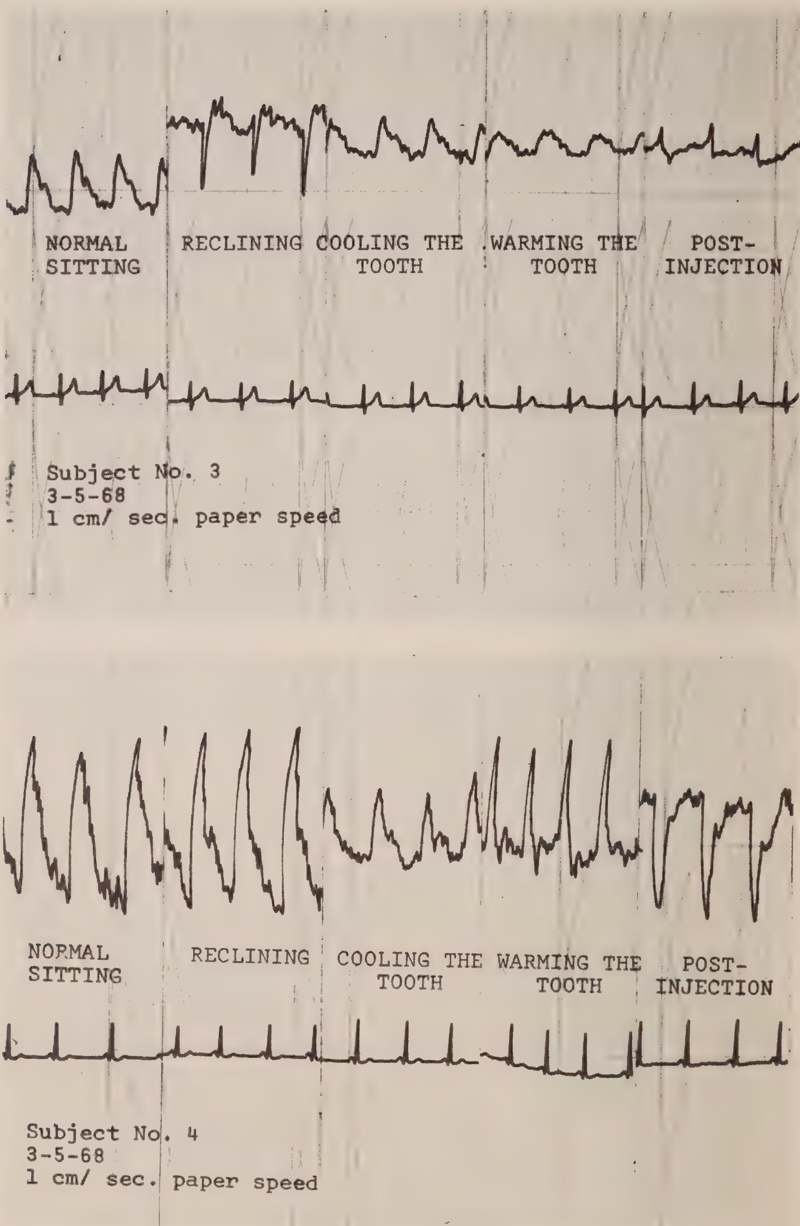


FIGURE 6 Results of Tests.

The records were mounted in such a way as to provide visual comparison of the inconsistency of the results from: test to test on each subject (left to right), comparison of test to test on both subjects (top to bottom), and comparison of subject to subject (top to bottom).

It should be noted that the records presented in Figure 6 of subjects 3 and 4 were chosen as representative of the ten subjects. The results of the test ranged from no change in amplitude and form to the wide range and bizarre changes as presented in Figure 6.

Figure 7 demonstrated the sensitivity of the intraoral appliance to movement. The first record showed the disruption of the recording when the subjects swallowed. The second and third records showed the results of the subjects touching the appliance or shielded cable with their tongues.

The tests were not confined to the central incisors. The first record in Figure 8 is a recording of pulpal circulation of a maxillary cuspid. The second is a recording of a non-vital, endodontically treated tooth; and, as expected, no pulsations were recorded. The latter record demonstrated the possibility of utilizing this instrumentation to determine pulpal vitality. The one fluctuation in this record was due to a slight movement of the appliance.

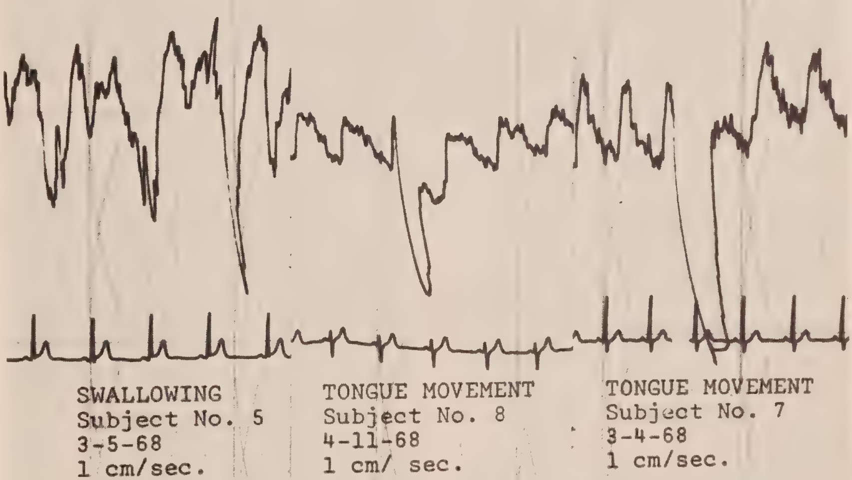


Figure 7 SENSITIVITY OF APPLIANCE TO MOVEMENT

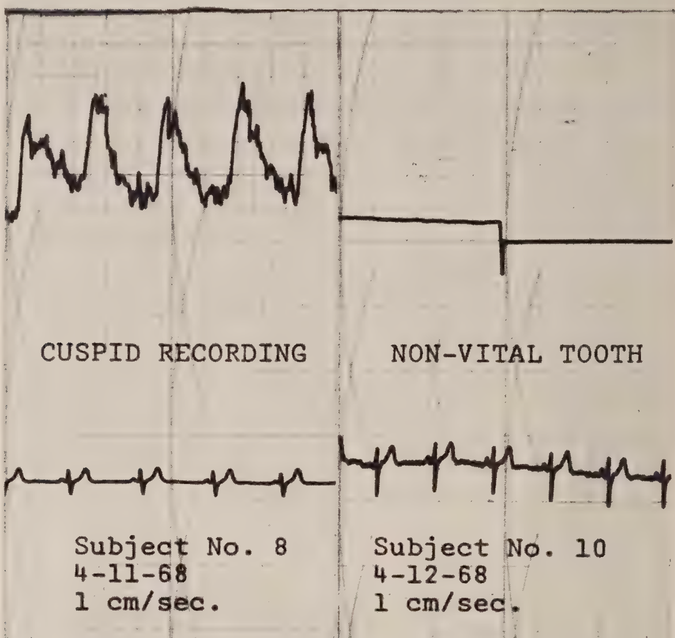


Figure 8 RECORDS OBTAINED FROM A MAXILLARY CUSPID AND A NON-VITAL TOOTH

DISCUSSION

The rhythmic pulsations recorded with the intra-oral photoconductive cell appliance were synchronous with the electrocardiogram, and demonstrated an optical change occurring within the tooth. This physical change was due to pulsations in the arterial circulation produced by the rhythmic action of the heart.

It is possible that these optical changes can be produced as fresh arterial blood, having a peak absorbance of 550 millimicrons, and that this fresh arterial blood replaces the reduced blood, with a peak absorbance of 700 millimicrons. It is suggested that this continuous rhythmic replacement of reduced blood with oxygenated blood produces the change in optical density, which has been recorded Eldrup-Jorgenson, et al (1966); Upthegrove, et al (1966).

Another possible reason for the physical change in optical density is that the flow of blood in the vessels is normally laminar or streamlined. This type of flow is due to an increasing velocity of the blood from the wall of the vessel toward the center of the stream.

The cellular elements of blood are also subjected to this laminar flow. The cells are reorganized within the walls of the vessels during systole. Thus, the rhythmic changes in velocity of flow and the resultant alterations in the laminar flow conceivably can cause the change in optical density.

In a closed elastic system, changes in volume and pressure are inseparable. An increase in pressure is accompanied by an increase in volume, the degree of rise in pressure being greater in a system of lesser compliance. The hemodynamics of the blood flow in the dental pulp are quite different from those in other parts of the body due to the encasement of the tissue within a rigid container. Thus, the character of the container is responsible for the character of the recorded pulsations.

The passage of a light beam through the tooth to measure the optical density requires that the path and angle through the interfaces remain constant throughout the experiment.

The intra-oral appliance was designed to provide for stability of the appliance on the tooth to be tested. The use of "Thiokol" rubber provided retention and stability throughout the tests. However, it was found that the appliance had to be more firmly bound to the tooth so that the tooth and appliance were as one unit before quantitative studies could be made. Therefore, the detection of any changes that could have occurred due to a change in postural or thermal change, or due to the administration of a local anesthetic with epinephrine was not consistent with this instrumentation.

The experiment was performed in order to show the potentialities inherent in this technique. Each of the problems considered should be investigated separately. Further investigation should begin with models in order to determine the optical characteristics of blood and blood in motion. Animal investigation could provide a more controllable experimental atmosphere in that the effects of physical and chemical agents on pulpal circulation could be better assessed.

The instrumentation will require further developments if quantitative studies are to be made with this technique. These refinements will consist of a higher intensity light with a similar peak spectral response. These need be utilized with sophisticated electronic equipment. As stability is of utmost importance, a method of cementing the appliance to the tooth or firm attachment will be essential for detection of quantitative changes in circulation. This, however, will deter from the versatility of the present appliance which, in its present form, could be easily modified and utilized as an instrument to determine pulp vitality.

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Interactions of Drugs Used in Dentistry-Clinical Implications and Methods of Prevention

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Interactions of Drugs Used in Dentistry-Clinical Implications and Methods of Prevention

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I. INTRODUCTION

Drug interactions is but one of several categories of adverse drug effects. It is defined as the action of an administered drug upon the effectiveness or toxicity of another drug administered earlier, simultaneously, or later. It is a problem of growing concern to the medical profession because of the increased incidence of multiple drug therapy. It has been observed that the average hospitalized patient receives 14 different medications during confinement (Cluff, *et al.*, 1964).

Dentistry has more than just an academic interest in this drug problem. Much of the population receiving dental treatment is receiving concurrent drug therapy in the form of prescribed medication from a physician or as over-the-counter self medication. Every dentist should be aware that medication prescribed by him may interact with other drugs to produce undesired biological effects in his patient. Attempts must be made to prevent drug interactions in dentistry. The ability of each prescriber to intelligently predict potential interactions is one way of partially solving this drug problem. Success through this approach depends on the responsibility of the dentist to know the basic facts about the action and side effects of the current therapeutic arsenal. Although there exists over 7,000 generally available drug preparations, dentistry utilizes only a small portion of these preparations in practice. By being familiar with the "dental" therapeutic arsenal, each dentist can be in a position to more knowledgeably predict potential interactions.

A second approach to solving this problem is to keep abreast of the developments in the field of "dental" drug interactions. Hence, a review of the subject is necessary. It is the intent of this review to serve as a guide to the dentist in preventing drug interactions. Important interactions which have occurred or could possibly occur through the use of dental drugs will be reviewed. Also, a preventive screening procedure specifically designed for office use is introduced.

II. DEFINITIONS AND CONCEPTS

The interaction of two or more drugs can result in (a) a hazardous reaction or (b) an increase or decrease in pharmacologic activity. The former effect has been defined as a therapeutic incompatibility, while the latter has been regarded as a therapeutic interaction (Lamy and Blake, 1970). A more convenient classification for dental purposes is antagonism and potentiation. Antagonism occurs when the combined effects of two or more drugs are less than those of the active drug alone. Potentiation occurs when the resultant effect is synergistic. For this review, potentiation is considered to result in a hazardous reaction or an increase in the pharmacologic activity of the active drug. Antagonism is considered to result in a decrease in activity.

Drug antagonism or potentiation results when one drug influences one or more of the following aspects of other drugs: gastrointestinal absorption, plasma protein binding, transport to the site of action, biotransformation, renal excretion, action at receptor sites, or alteration of internal milieu, electrolyte balance, or acid-base equilibrium. It is not within the scope of this review to illustrate by examples these mechanisms of drug interactions and the reader is referred to other general reviews on the subject (Goth, 1970; Hartshorn, 1970; Hussar, 1968).

This review of dental drug interactions includes those interactions which are potentially most dangerous to the patient and which can be caused by drugs routinely prescribed in dentistry. It omits interactions associated with anesthetic agents and those which have been observed only after administration of large doses of drugs for long periods of time to animals. For purposes of accuracy, differentiation is made between clinical reports and those interactions only observed in animals. Only those interactions which have been properly documented by original reports in the literature and reliable textbook sources are discussed.

III. DENTAL DRUG INTERACTIONS

A. Addicting Analgesics

In general, the central nervous system depression produced by morphine and meperidine is potentiated by alcohol, sedatives, hypnotics and antihistamines. Serious reactions have occurred clinically through the use of meperidine. The simultaneous administration of this drug with monoamine oxidase inhibitors (MAOI) has led to a deep coma (Shee, 1960) and extreme hypotension resulting in a depressor crisis (Vigran, 1964). Eade and Renton (1970) reported this effect to be partially due to an inhibition of meperidine degradation by MAOI.

Both the respiratory depression and the analgesia produced by narcotic agents can be enhanced by various drugs. For example, the phenothiazine derivatives including propiomazine (Hoffman and Smith, 1970), chlorpromazine (Lambertsen, *et al.*, 1961) and promazine (Morton and Turnbull, 1964) have dangerously exaggerated and prolonged the respiratory depression of meperidine. The in-

herent hypotensive action of these phenothiazine derivatives is an additional complication to the sedative action of morphine and meperidine. Imipramine-like drugs exert a supra-additive effect on morphine and meperidine induced respiratory depression (Goodman and Gilman, 1970a). Phenothiazines also are able to reduce the dose of morphine and meperidine required to produce a given level of analgesia (Goodman and Gilman, 1970a). Diazepam has been shown to enhance the analgesia produced by meperidine (Niswander, 1969). Concomitant administration of meperidine with amphetamine (Goodman and Gilman 1970b) and with neostigmine (Christensen and Gross, 1948) has enhanced its analgesic effect. Houde *et al.* (1965) observed that the analgesic potency of codeine was enhanced by the simultaneous administration of aspirin, an effect which is clinically beneficial.

Animal studies have indicated other potential clinical interactions involving the narcotic agents. Herz, (1961) observed that the anticholinergic action of scopolamine potentiated the sedative action of morphine in rats. Eerola (1962) investigated the combined action of atropine and morphine in mice and showed that the anticholinergic effects of atropine were enhanced. The ganglionic blocker mecamylamine has potentiated the analgesia produced by morphine in rats (Gupta and Dhawan, 1961). Reserpine however caused a decrease in the analgesic effect of meperidine as shown by the increase in the ED-50 for meperidine in reserpine pretreated rats (Sethy *et al.*, 1970). Preliminary reports have indicated that the antibacterial furazolidone enhances meperidine depression in man (Hartshorn, 1970) and that the beta blocking agent propranolol potentiates the central nervous system depression induced by morphine (Dunphy, 1969).

B. Non-Addicting Analgesics

Bleeding episodes have occurred after the administration of salicylates to patients on anticoagulant therapy with the coumarin derivatives (Roos and van Joost, 1965). This reaction was due to a decrease in blood prothrombin levels and subsequent increase in prothrombin time caused by salicylates (Hussar, 1970). Salicylates are able to displace the coumarin-type anticoagulants from protein binding sites in plasma. This action results in increased peak plasma concentrations of the free anticoagulant with a resultant decreased plasma half-life of the drug (Sandler, 1970). Acetaminophen, like salicylates, will also potentiate anticoagulant drugs by increasing the normal physiological prothrombin times (Antlitz *et al.*, 1968).

Several other clinical interactions involving salicylates have been reported. Krakoff (1967) observed that the uricosuric action of aspirin and probenecid was inhibited when the two drugs were administered simultaneously. This action may result in a hazardous situation in patients suffering from gout. The non-steroidal anti-inflammatory agent phenylbutazone has been observed to inhibit the uricosuric activity of aspirin (Hussar, 1968). Klinenburg and Miller (1965) observed that administration of salicylates during a tapering of corticosteroid dosage in four patients resulted in an increased

plasma level of unbound salicylates with concomitant salicylate intoxication in one of the patients.

When acetanilid was administered to patients on chlorpromazine therapy, there occurred an increase in the non-metabolized chlorpromazine serum levels, an action which resulted in a potentiation of the effects of chlorpromazine (Huang and Hirano, 1967). These investigators hypothesized that acetanilid competed with chlorpromazine in the formation of excretable metabolites.

Other actions of salicylates, although not observed clinically, are of importance to this discussion. Aspirin, indomethacin and phenylbutazone when administered together can cause enhanced irritation to the gastrointestinal tract. Any combination of these drugs may cause enhancement of their ulcerogenic effects (McDougal, 1970). McDougal (1970) has also indicated that salicylates cause as much as 50% decrease in sodium and chloride ion excretion in humans, an action which may antagonize the action of thiazide diuretics. Hartshorn (1970) has reported that propoxyphene potentiates the anti-parkinson agent orphenadrine, an interaction which may result in tremors, mental confusion and anxiety.

C. Chemotherapeutic Agents

Various anti-infective drugs are able to enhance the effect of simultaneously administered anticoagulants in man. Hussar (1970) has indicated that this effect is due to interference of vitamin K synthesis in micro-organisms of the gastrointestinal tract. Penicillins, sulfonamides, tetracyclines and chloramphenicol are specific agents most likely to cause problems of this nature. The gastrointestinal tract absorption of some anti-infectives in man can be impaired by various agents. For example, certain antacids which contain divalent heavy metal ions prevent absorption of tetracyclines (Kunin and Finland, 1961). Neuvonen *et al.,* (1970) reported 50-90% lower serum levels of tetracycline when administered simultaneously with 40 mg of ferrous sulfate. Lincomyin failed to clear up a severe dental infection because the absorption of the drug was inhibited by cyclamates which were inadvertently ingested with the drug (Francis and Kutscher, 1970). Tetracyclines are able to antagonize the antimicrobial activity of simultaneously administered penicillin (Lepper and Dowling, 1951).

Sulfonamides, due to their affinity to bind to plasma proteins can displace certain sulfonylurea hypoglycemics, particularly tolbutamide, thereby increasing the plasma levels of free drug. This action has resulted in a hypoglycemic coma (Christensen *et al.,* 1963). Sulfonamides can also cause an increase in anticoagulant response due to displacement of coumarin-like anticoagulants from plasma protein binding sites. Hussar (1970) has indicated that sulfamethoxypyridazine competes specifically with warfarin for the same binding sites on human albumin.

Animal studies have indicated that sulfonamides can be displaced from plasma albumin binding sites by agents having a greater binding affinity-e.g. phenylbutazone and salicylic acid. Clinically, this action may result in increased activity of

the sulfa drugs (Anton, 1960). Kunin (1964) demonstrated *in vitro*, that sulfa drugs will displace penicillins from plasma protein binding sites. This action may be responsible for the apparent synergism reported for the two drugs. Upon systemic administration, local anesthetics of the p-aminobenzoic acid ester type interfere with the antibacterial effects of sulfonamides (Hussar, 1968).

Two important clinical interactions have been observed with penicillins. Probenecid produces increased plasma levels of unbound penicillin (Gibaldi and Schwartz, 1968). This action is most likely due to two mechanisms — the inhibition of the renal tubular secretion of penicillin and the displacement of penicillin from plasma protein binding sites. Also, salicylates, sulfonamides and p-aminobenzoic acid have been shown in humans to displace penicillin from inactive binding sites in the serum (Kunin, 1966). Both of these interactions of penicillin cause an enhancement of its antimicrobial activity *in vivo*.

D. Sedatives, Hypnotics, Tranquilizers

As a general rule, any combination of alcohol, barbiturates, antihistamines, phenothiazines, benzodiazepines, tricyclic antidepressants or meprobamate should be avoided since enhancement of sedation by one another will result. Severe barbiturate intoxication occurred in a patient treated with a MAO inhibitor (Domino *et al.*, 1962). Phenobarbital decreased the effectiveness of coumarin anticoagulants and diphenylhydantoin in man by stimulating the formation of hepatic microsomal enzymes necessary for the metabolism and subsequent elimination of these agents (Cucinell *et al.*, 1965). Phenobarbital also interacts with griseofulvin to reduce the blood levels of this antifungal agent in man. Bushfield *et al.* (1963) proposed this effect to be due to an increased metabolism of griseofulvin. Riegelman *et al.*, (1970) however recently reported that the gastrointestinal absorption of griseofulvin was inhibited when phenobarbital was administered simultaneously in man. An interaction of potential clinical significance was proposed by Boulos *et al.* (1970), who showed that quinine potentiates the hypnotic effect of pentobarbital in animals by inhibiting its metabolism and subsequent elimination from the body.

Chloral hydrate and glutethimide promote the metabolism of coumarins, thus decreasing their effectiveness (Cucinell *et al.*, 1966). Dunphy (1969) also reported a similar action to the coumarin anticoagulants by ethchlorvynol, a non-barbiturate sedative hypnotic. Phenothiazines and tricyclic antidepressants are incompatible because they produce atropine-like excitement and convulsions (Goth, 1970). Phenothiazines have also caused an enhanced hypotension in the presence of reserpine and thiazide diuretics (Goth, 1970). Nylidrin reportedly potentiates the effects of phenothiazines by releasing the drug from inactive binding sites in the body (Chu *et al.*, 1966). An increased excretion of unchanged phenothiazines into the urine of patients is caused by oral contraceptives and it is thought that this action is a result of potentiation of the phenothiazines (Antonito, 1968).

Kane and Taylor (1963) have observed an enhancement of the sedative and atropine-like effects of desipramine (a tricyclic antidepressant) by the benzodiazepine compounds chlordiazepoxide, diazepam and oxazepam. Chlordiazepoxide has also been shown to potentiate the side effects of amitriptyline, an action which resulted in a condition resembling brain damage (Dunphy, 1969).

E. Miscellaneous Agents

Atropine exerts an additive effect when administered simultaneously with various agents. Gershon *et al.*, (1965) reported that it potentiates the phenothiazine sedation in man via an additive CNS depressant effect. Hartshorn (1970) reported an additive anticholinergic effect between isoniazid and atropine.

Nasal bleeding, acute dryness of the mouth, fissures of the tongue, and cracked lips occurred when diphenhydramine in combination with methaqualone was administered to a patient previously medicated with the antipsychotic agent thioridazine (Kessell, *et al.*, 1967). Winer and Bahn (1967) reported that diphenhydramine in combination with the anticholinergic drugs trihexyphenidyl and imipramine caused a loss of dentition in a patient as a result of prolonged xerostomia. Pyridoxine (vitamin B-6) reportedly reduces the clinical benefits of the new antiparkinson agent L-dopa (Cotzias, 1969). Patients taking B-complex vitamins with L-dopa should be sure vitamin B-6 is not present.

VI. OFFICE SCREENING PROCEDURE

A practical approach to the problem of dental drug interactions must consist of a relatively simple screening procedure designed to alert the dentist of potential interactions. A system is suggested which considers the following:

a. A description of those interactions which are of clinical importance,

b. Classification of the interactions into a table which can be readily referred to,

c. A list of drugs used in dentistry by trade name and generic name with reference to their interactions.

The selected drug interactions are described in Table 1. The interactions have been selected on the basis of frequency of occurrence and clinical significance. For simplicity, the interactions are listed according to potentiation and antagonism. No description is given of the resultant effect or the mechanism of the interaction. Also, no consideration is given to those interactions involving drugs with local or general anesthetics. The table is constructed on the premise that a drug can act as the primary agent in the interaction (the drug being prescribed), or as the interactant (the drug a patient has previously taken).

The second part of the screen is a list of drugs normally prescribed in dentistry (Table 2). The drugs are listed alphabetically by trade name (unless indicated by the word "unspecified" which means that the drug is commonly known by its generic name). The generic name, where applicable, is also listed. Reference numbers are listed to identify the interactions which occur with the drug as listed in Table 1. The primary reference

numbers refer to the role of the drug as the primary interactant while the interactant reference numbers refer to its role as the interactant.

As an example of how to screen a drug consider the following. Benadryl (an antihistamine) is listed in Table 2 with its generic name diphenhydramine. The primary reference is 9 and the interactant references are 5 and 15. Referring to Table 1, 9 indicates that as the drug being prescribed, diphenhydramine is specifically enhanced by anticholinergics. Five and 15 indicate that as an interactant, diphenhydramine (as the antihistamine) enhances barbiturates and narcotics. When a drug preparation consists of more than one ingredient, those generic ingredients which can involve themselves in interactions are listed and reference is made to each.

Assuming the prescriber knows the drug history of the patient, this screening procedure is intended to provide the following service.

a. It will tell the dentist if the drug he prescribes may cause a possible adverse situation by interacting with medication the patient has previously taken.
b. It will tell the dentist if the medication the patient is on may possibly alter the responses to the drug being prescribed.
c. It will place the dentist in a unique position to inform the patient of possible adverse situations already present due to previous multiple drug therapy.

The list of dental drugs (Table 2) and their interactions (Table 1) should not be considered complete since important new clinical interactions are constantly being reported in the literature. It is suggested that additions be made by each prescriber as new interactions are reported or observed.

Table 1. Selected Interactions of Dental Drugs

	Primary Drug	*Action*	*Interactants*
1.	Acetaminophen	potentiates	coumarin anticoagulants
2.	Aspirin	antagonizes	probenecid
3.	Aspirin	enhanced by	corticosteroids, indomethacin, phenylbutazone
4.	Atropine	potentiates	phenothiazines
5.	Barbiturates	enhanced by	MAOI, anthihistamines, phenothiazines, tranquilizers, sedatives, alcohol
6.	Chlordiazepoxide	potentiates	amitryptyline, desipramine
7.	Coumarins	enhanced by	penicillins, sulfonamides, tetracyclines, erythromycin
8.	Coumarins	antagonized by	chloral hydrate, glutethimide, ethchlorvynol
9.	Diphenhydramine	enhanced by	anticholinergics
10.	Meperidine	enhanced by	MAOI, phenothiazines, diazepam, neostigmine, furazolidone
11.	Meperidine	enhanced by	amphetamine
12.	Meperidine	antagonized by	reserpine
13.	Morphine	enhanced by	propranolol
14.	Narcotics	potentiate	atropine
15.	Narcotics	enhanced by	hypnotics, sedatives, antihistamines, phenothiazines
16.	Penicillins	enhanced by	probenecid, salicylates
17.	Phenobarbital	antagonizes	coumarin anticoagulants, diphenylhydantoin, griseofulvin
18.	Phenothiazines	potentiate	reserpine, thiazide diuretics
19.	Phenothiazines	enhanced by	nylidrin
20.	Propoxyphene	enhanced by	orphenadrine
21.	Salicylates	potentiate	coumarin anticoagulants
22.	Sulfonamides	potentiate	tolbutamide, penicillins
23.	Sulfonamides	enhanced by	phenylbutazone, salicylates
24.	Tetracyclines	antagonized by	antacids, iron preparations
25.	Tetracyclines	antagonize	penicillins

Table 2. References to Interactions of Dental Drugs

Trade Name	*Generic Ingredients of Importance*	Reference	
		Primary	*Interactant*
Achromycin V	tetracycline	24, 25	7
Alurate	aprobarbital	5	15
Amphetamine (unspecified)	amphetamine		11
Ampicillin (unspecified)	ampicillin	16	7, 22, 25
Amytal	amobarbital	5	15
APC w/Demerol	aspirin, meperidine	2, 3, 10, 11, 12, 14, 15	5, 16, 23
Aspirin (unspecified)	aspirin	2, 3	16, 23
Atropine (unspecified)	atropine	4	9
Aureomycin	chlortetracycline	24, 25	7
Benadryl	diphenhydramine	9	5, 15
Butisol Sodium	butabarbital	5	15
Chloral Hydrate (unspecified)	chloral hydrate	—	5, 8, 15
Compocillin V-K	Penicillin V	16	7, 22, 25
Codeine (unspecified)	codeine	14, 15	5
Darvon	propoxyphene	20	—

Table 2. References to Interactions of Dental Drugs—Continued

Darvon Compound-65	propoxyphene, aspirin	2, 3, 20	16, 23
Darvon w/ASA	propoxyphene, aspirin	2, 3, 20	16, 23
Darvotran	propoxyphene	20	—
Declomycin	demethylchlortetracycline	24, 25	7
Demerol	meperidine	10, 11, 12, 14, 15	5
Dilaudid	dihydromorphinone	14, 15	5
Doriden	glutethimide	—	5, 8, 15
Empirin Compound w/codeine	aspirin, codeine	2,3,14,15	5, 16, 23
Erythrocin	erythromycin	—	7
Erythromycin (unspecified)	erythromycin	—	7
Equagesic	aspirin, meprobamate	2, 3	5, 15, 16, 23
Equanil	meprobamate	—	5, 15
Fiorinal	butalbital, aspirin	2, 3, 5	15, 16, 23
Fiorinal w/codeine	butalbital, aspirin, codeine	2, 2, 5, 14, 15	5, 15, 16, 23
Ilosone	erythromycin	—	7
Librium	chlordiazepoxide	6	5
Lincocin	lincomycin	—	7
Mepergan	meperidine, promethazine	10, 11, 12, 14, 15, 18, 19	
Meprobamate (unspecified)	meprobamate	—	5, 15
Miltown	meprobamate	—	5, 15
Morphine (unspecified)	morphine	13, 14, 15	5
Nembutal	pentobarbital	5	15
Noctec	chloral hydrate	—	5, 8, 15
Penicillin G Potassium	penicillin G	16	7, 22, 25
Pentids	penicillin G	16	7, 22, 25
PenVee K	penicillin V	16	7, 22, 25
Percodan	oxycodone, aspirin	2, 3, 14, 15	5, 16, 22
Phenergan	promethazine	18, 19	4, 5, 10, 15
Phenaphen w/codeine	aspirin, phenobarbital, codeine	2, 3, 5, 14, 15, 17	5, 15, 16, 23
Phenobarbital (unspecified)	phenobarbital	5, 17	15
Rondomycin	methacycline	24, 25	7
Seconal	secobarbital	5	15
Sulfonamides (unspecified)	sulfonamides	22, 23	7
Sumycin	tetracycline	24, 25	7
Terramycin	oxytetracycline	24, 25	7
Tetracycline (unspecified)	tetracycline	24, 25	7
Tylenol	acetaminophen	1	—
Tylenol w/codeine	acetaminophen, codeine	1, 14, 15	5
Valium	diazepam	—	5, 10, 15
Vibramycin	doxycycline	24, 25	7
Zactirin Compound	aspirin	2, 3	16, 23

PROPRIETARY DRUG NAMES

Drug	*Name*
acetaminophen	Tempra, Tylenol
amitriptyline	Elavil
amphetamine	Benzedrine
chloral hydrate	Noctec
chloramphenicol	Choromycetin
chlordiazepoxide	Librium
chlorpromazine	Thorazine
desipramine	Norpramin, Pertofrane
dextro-amphetamine	Dexadrine
diazepam	Valium
diphenhydramine	Benadryl
diphenylhydantoin	Dilantin
ethchlorvynol	Placidyl
ferrous sulfate	Feosol
griseofulvin	Fulvicin, Grifulvin, Grisactin
glutethimide	Doriden
imipramine	Tofranil
indomethacin	Indocin
lincomycin	Lincocin
mecamylamine	Inversine
meperidine	Demerol
meprobamate	Equanil, Miltown
methaqualone	Quaalude
neostigmine	Prostigmine
nylidrin	Arlidin
orphenadrine	Disipal
oxazepam	Serax
pentobarbital	Nembutal
phenylbutazone	Butazolidin
probenecid	Benemid
propranolol	Inderal
propoxyphene	Darvon
reserpine	Serpasil
sulfamethoxypyridazine	Kynex
tetracycline	Achromycin, Sumycin
thioridazine	Mellaril
trihexyphenidyl	Artane
tolbutamide	Orinase
warfarin sodium	Coumadin

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Blue Nevi of the Oral Mucosa

Bernard A. Levy, D.D.S., M.S.D.*

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Blue Nevi of the Oral Mucosa

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SUMMARY

This paper documented what was believed to be the twentieth case of an intraoral blue nevus reported in the English language. The clinical manifestations and histologic features of the lesion were described. The nineteen previously reported cases were tabulated.

INTRODUCTION

The blue nevus is generally regarded as an uncommon pigmented lesion of skin. The occurrence of a blue nevus in the oral cavity is considered rare. This paper will report and document a blue nevus of the hard palate.

CASE REPORT

A seventy-four year old black woman came to the dental clinic, University of Maryland School of Dentistry, for a new set of dentures. During a routine intraoral examination, a three millimeter blue-black lesion was observed in the midline of the hard palate. (Fig. 1) The lesion was smooth surfaced, non-elevated, and not ulcerated. It was located one centimeter posterior to the incisive papilla. The patient was unaware of this asymptomatic lesion. The differential diagnosis included amalgam tattoo, foreign body, and blue nevus. An excisional biopsy was performed. The specimen was formalin fixed and routine histologic sections were prepared. The biopsy site healed normally and no residual pigmentation was seen.

The sections revealed a hemisected mass of soft tissue covered by keratinized stratified squamous epithelium. The basal cell layer contained melanin pigment and was intact. The subjacent connective tissue was dense and collagenous. The deeper portions of the specimen showed large amounts of dark brown pigment within numerous spindle-shaped cells having long cytoplasmic processes. A diffuse swirled pattern of spindle cells admixed with pigment-laden histiocytes was observed. (Figs. 2 & 3) An iron stain for hemosiderin was negative, while a melanin bleach was positive. A Fontana stain confirmed the pigment to be melanin (Figs. 4 and 5). The diagnosis was blue nevus of the palate.

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SUMMARY OF CASES

Author	*Number of Cases*	*Sex*	*Age*	*Race*	*Location*
Scofield[1]	2	Male Female	24 41	White White	Hard palate Hard palate
Sprague and Dirlam[2]	1	Male	18	White	Hard palate
Bhaskar and Jacoway[3]	3	Female Male Female	25 46 17	White[10] White[10] White[10]	Hard palate Hard palate Hard palate
Harper and Waldron[4]	1	Male	69	White	Soft palate
Mark and Kaplan[5]	1	Female	34	White	Hard palate
Bogomoletz[6]	1	Male	42	White	Hard palate
McCrea, *et al.*[7]	2	Female Female	24 28	White Black	Hard palate Lower lip
Thoma and Robbins[8]	1	Male	45	Black	Buccal mucosa
Mack and Woodward[9]	1	Male	32	White	Hard palate
Brenner and Harrison[10]	1	Female	34	Black	Upper lip
Buckley and Russell[11]	1	Female	28	White	Lower lip
Goldberg, *et al.*[12]	1	Male	63	White	Hard palate
Lavine[13]	1	Female	73	Black	Hard palate
Weathers[14]	1	Female	20	White	Upper lip
Kjaerheim, *et al.*[15]	1	Male	14	Black	Hard palate
Levy	1	Female	74	Black	Hard palate
TOTAL:	20	9 Male 11 Female	14-74	6 Black 14 White	14 Hard palate 1 Soft palate 2 Upper lip 2 Lower lip 1 Buccal mucosa
		Average Age:	37 years		

All of the above cases were under one centimeter in diameter. The duration of these lesions in all cases was either present since birth, very long, or unknown.

DISCUSSION

In view of the limited number of reported cases, epidemiologic speculation may be hazardous. Some general observations were noted. No sex predilection was seen. A very wide age range was observed. The present case was the oldest reported. One case[13] was present at the time of birth. Since the exact duration was unkown in the remaining cases, it was possible they were all present since birth. There also appeared to be a marked predilection for this lesion to occur on the hard palate. No

FIGURE 1

Clinical photograph of the blue nevus.

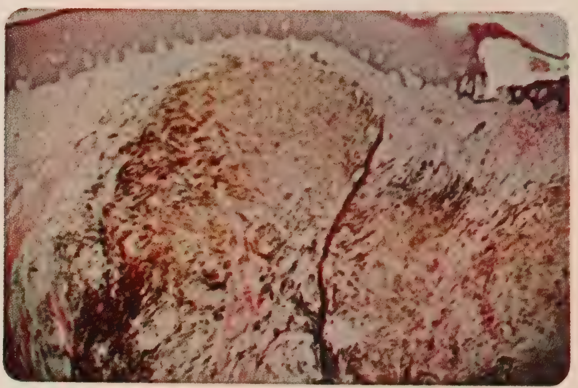

FIGURE 2

Photomicrograph of the blue nevus. Original magnification 50X, hematoxylin and eosin stain.

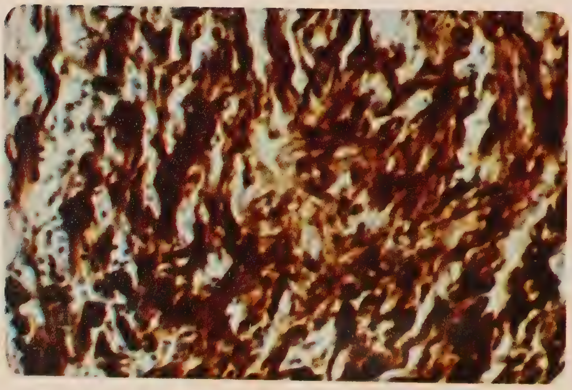

FIGURE 3

Photomicrograph of the blue nevus. Original magnification 400X, hematoxylin and eosin stain.

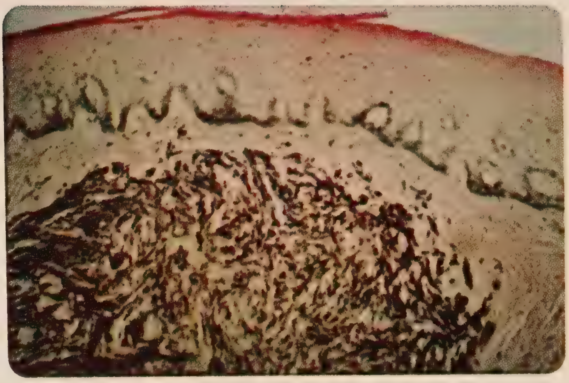

FIGURE 4

Photomicrograph of the blue nevus. Original magnification 100X Fontana-Masson stain

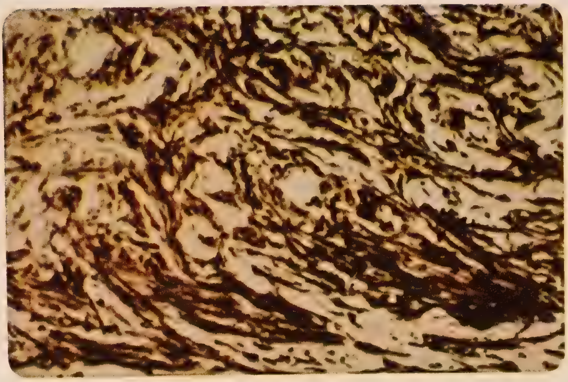

FIGURE 5

Photomicrograph of the blue nevus. Original magnification 200X, Fontana-Masson stain

explanation was readily available.

The lesion shows a marked clinical resemblance to the amalgam tattoo. It is possible that the blue nevus is far more common than reported cases would indicate, for amalgam tattoos are rarely biopsied to confirm the clinical diagnosis. Until a larger series of cases are available, only speculation of the nature of the lesion is possible.

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Evaluation of Smoking Habits of Dental Students

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Evaluation of Smoking Habits of Dental Students

Part 1. Preliminary Report of Study Design

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SUMMARY

This report discusses the smoking habits of dental students at the University of Maryland, School of Dentistry. The investigators determined the smoking status of individuals by questionnaires. Interpretation of the longitudinal data identified the pitfalls in generalization of results obtained by cross-sectional techniques. Statistically significant changes in various smoking categories were revealed in the cross-sectional analysis, which were not present in the longitudinal analysis. Analysis of the baseline study group data may present results applicable only to that group; current and recent environmental influences may propose a contrasting portrait of future study groups.

INTRODUCTION

A previous study by these investigators, directed at describing the smoking habits of dental students, suggested that more students will be non-smokers upon graduation.[1] The rationale for such a conclusion was based on the finding that more non-smokers were entering dental school, and that the non-smokers plus an additional proportion of dental students ceasing to smoke, would embellish an increasing pool of non-smokers. However, the investigators are aware of the limitations of interpreting and over-reading data from cross-sectional studies.

Further investigation was indicated to determine the reliability and validity of those findings. The objectives of this study were:

1. to compare the smoking habits of freshman-sophomore (lower classmen) dental students to junior-senior (upper classmen) dental students;
2. to compare the smoking habits of dental students by academic years;
3. to design a longitudinal study of the smoking habits of dental students;
4. to demonstrate the limits of inferential data interpretation of cross-sectional studies.

METHODOLGY

The student body at the University of Maryland, School of Dentistry, was issued questionnaires relating to their smoking habits. The questions were designed to ascertain if the individual was an active smoker, and if so, the type of smoking habit; the alternatives would be (1) that the individual was not a smoker at the time of the study, but previously had

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smoking experience, and (2) that the individual was not a smoker at the time of the study, and had no previous smoking experience. Smokers were established to be those individuals that smoked at least 5 cigarettes daily or the equivalent in pipefuls of tobacco or cigars. One cigarette was established to be equal to 1/2 pipeful of tobacco or 1/4 of a cigar.[2]

The population surveyed consisted of the freshman, sophomore, junior, and senior students. The evaluation of the smoking habits was completed in two tracks; (1) the classes were compared to each other in ascending order, from freshmen to sophomores, sophomores to juniors, and juniors to seniors; and (2) the classes were divided into two groups, the freshman and sophomore dental students comprising Group 1, and the junior and senior dental students comprising Group II. The rationale for track I analysis is obvious, however, the rationale for track II was to divide the student population into lower and upper classmen, the groupings placing all those students who are exposed to more intense patient contact into one separate category, opposed to the grouping of lower classmen having the most recent exposure to the basic sciences, and minimal patient contact.

RESULTS

Tabulation and analysis of smoking experience of 401 students were completed for the academic year 1969-70. Track I analysis involved 103 respondents in the freshman year, 101 sophomores, 102 juniors, and 93 senior respondents. There were therefore, 204 subjects in Group I, and 197 in Group II, for track II analysis. The number of non-participants was negligible and the problem of accounting for non-respondents was not necessary.

There was a statistically significant difference at the 95% level, between smokers in Groups I and II; (Table 1) in addition, there is a significant difference between non-smokers with a past history of smoking, or previous smokers. No significant difference was obtained between Group I and Group II students for non-smokers without a previous history of smoking.

There was no significant difference at the 95% level, between the individual study year populations for proportion of smokers in each year, that is, freshmen to sophomores, etc. The same was true for proportions of non-smokers between the reference year populations. However, there was a statistically significant difference at the 95% level, between previous smokers when the freshman students were compared to the sophomores, and similarly when the sophomores were compared to the juniors. In contrast to these findings, these was no significant difference for previous smokers between the junior and senior dental students.

The frequency distribution of smoking habits of Group I subjects and Group II subjects is demonstrated in Table 2. Comparing the specific rates, Group I not only presents proportionately fewer smokers, that is, 30.8% of the total Group I population, than Group II, but also a greater proportion of members of Group I have stopped smoking than members of Group II.

DISCUSSION

This study points out several pitfalls that the investigator must be cognizant of in interpretation of data. Analysis of the original data reflects that Group I students (Freshman and Sophomore Students) are significantly different in proportions of individuals ceasing to smoke than Group II students (Junior and Senior Students), that is, a smaller percentage of Group II students cease their smoking habit. The simplest interpretation for this phenomenon is that alteration of smoking habits between the Groups is due to gradual increased patient contact in the clinic, better understanding of the potential pathogenicity of smoking, and more influence being exerted by public health education related media. Although investigators frequently do not accept the obvious, and seek more complex solutions, it is our observation that we cannot accept the aforementioned conclusions in toto. It must be noted, in support of those explanations, that further analysis of the data reveals that when the Groups are dissolved and comparison is accomplished between individual academic subgroups, there are similar findings. There are increased proportions of subjects stopping the smoking habit between the freshman and sophomore classes, and more so between sophomore and junior classes. However, there is no significant difference between junior and senior classes. These findings enhance the simple explanations. It must be emphasized that the study was a cross-sectional study and that when employing such a study design, the researcher must be cautious and refrain from taking great latitudes in interpreting the significance of the data. In this particular study, the interplay of multifaceted variables is most difficult to discern. Perhaps a modest approach in determining the stimulus for changes in smoking habits would be to simply ask each subject the reason for ceasing to smoke. But since the subject is aware of the central interest in smoking habits, his replies may reflect a subconscious or conscious desire either to satisfy the interviewer or to minimize his own perceived guilt, if it is present. It is self-evident that invalid conclusions may arise when, because of erroneous information, members of study populations are misclassified as to smoking status, as a result of unjustified presumption of study objectives, improperly phrased or leading questions, insensitive measurement tools, etc. We are aware of these pitfalls, and submit that to place any meaningful interpretation on the findings, a longitudinal study of a prospective nature should be accomplished. It should include comparative control groups of students of other professions, and the incorporation of questions directed toward documenting the behavioral attitudes of the subjects toward smoking. Perhaps the data accumulated at this time reflects the changes in smoking habits for this particular study population and cannot be considered to be representative of other similar populations at this institution, present and future. The initial step has been taken to demonstrate the necessity of employing longitudinal prospective directives to support or refute the findings of this study. The primary phase of this longitudinal approach has been completed, and demonstrates the lack of consistency between the

study groups. The schematic (Fig. 1) diagram for the proposed study reveals (1) the similarity of smoking habits for freshman comparative groups (A_1 and A_2) in smoking habits; (2) the similarity between sophomore groups (X and B_1); (3) the similarity between the primary freshman group which is now the sophomore group (A_1 and B_1); (4) and the similarity between the present freshman group and present sophomore group (A_2 and B_1). Our finding is that indeed our baseline study group may present results applicable only to that group, and that current and recent environmental influences will propose a contrasting portrait for future dental students. The changes influencing this variation in smoking habits, if they are in fact occurring, must be carefully and diligently identified.

TABLE 1

Statistical comparison of smoking habits of dental students at the University of Maryland, School of Dentistry, by level of academic standing, for the academic year 1969-70.

COMPARISON SELECTIONS

CLASSIFICATION

	S*	N.S.†	P.S.‡	
GROUP I: Freshmen Sophomores	+	—	+	GROUP II: Juniors Seniors
Freshmen	—	—	+	Sophomores
Sophomores	—	—	+	Juniors
Juniors	—	—	—	Seniors

* Smokers
† Non-smokers
‡ Previous Smokers
(+) Significant difference—95% Level
(—) Non-significant difference—95% Level

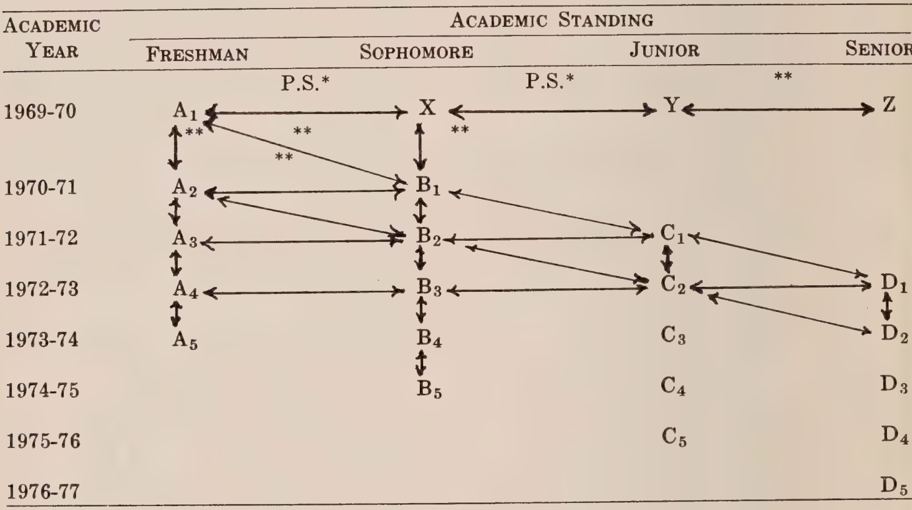
TABLE 2

Frequency and relative frequency distribution of smoking habits of 204 freshman — sophomore dental students (Group I) and 197 junior — senior dental students (Group II).

CLASSIFICATION	GROUP I	GROUP II
Smokers	63 (30.8%)	78 (39.5%)
Non-smokers	96 (47.1%)	88 (44.7%)
Non-smokers/with past history of smoking	45 (22.1%)	31 (15.8%)
TOTALS	204 (100.0%)	197 (100.0%)

FIGURE 1

Schematic diagram of longitudinal study of smoking habits of students at University of Maryland, School of Dentistry.



Categories: N = Smokers

N.S. = Non-smokers

P.S. = Non-smokers/with past history of smoking (Previous Smokers)

(*) = denotes significant difference—95% Level—for category so indicated

(**) = denotes no significant difference—95% Level—for all categories listed

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Unusual Structures of Specific Periodicity in the Midgut of Aged Drosophila Melanogaster

LESLIE P. GARTNER

Unusual Structures of Specific Periodicity in the Midgut of Aged Drosophila Melanogaster[1]

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Abstract Dense lines varying from 190 A to 3.3x10^4 A in length and possessing a periodicity of 80 A were noted in the midgut of aged *Drosophila melanogaster.* A possible relationship between these structures and previously reported virus-like particles was postulated.

INTRODUCTION

During electron microscopic examinations of the midgut of *Drosophila melanogaster* imagoes two types of virus-like particles, both hexagonal in shape, were noted, one in the cytoplasm and the other in the nucleus of the cells (Gartner, 1971). In the cytoplasm of a very small number of aged fruitflies nearly parallel dense lines having a specific periodicity were also observed (Figs. 1 and 3).

MATERIALS AND METHODS

The flies were lightly anaesthetised with ether, and the midgut was excised in cold, five per cent cacodylate buffered glutaraldehyde. The tissue was then fixed in cold, one per cent solution of osmic acid, buffered at a pH of 7.4 with veronal acetate (Palade, 1952). Subsequent to normal dehydration procedures the midgut was embedded in Epon 812, sectioned on either a Porter-Blum hand ultramicrotome or on an LKB automatic ultramicrotome, and mounted on bare copper grids. The sections were stained with uranyl acetate and lead citrate according to the methods of Watson (1958) and Reynolds (1963) respectively. The grids were then viewed with a RCA EMU-3F electron microscope.

OBSERVATIONS

A large percentage of the cells of the midguts of older individuals was infested with virus-like particles (Gartner, 1970). The cytoplasm of some of these cells was also seen to contain dense lines varying in length from 190 A to 3.3x10^4 A. Since such long segments were evident it is probable that these represent transverse sections of structures possessing length, width as well as some depth. The structures have a dense, electron opaque

[1]Work performed during the period of a United States Public Health Service Fellowship in the Department of Zoology and Physiology, Rutgers University, Newark, N. J. 07102. The electron microscopy was performed at the Max Wachstein Research Laboratory of the Beth Israel Hospital, Passaic, N. J. Part of this work was supported by Research Grand AM12818 o fthe National Institute of Arthritis and Metabolic Diseases.

core occupying their central plane, and short lines of nearly identical dimensions are radiating from, and perpendicular to, this central core, allocating the structure its particular characteristic, namely its specific periodicity of 80 A (Fig. 3). These structures were never seen singly, but always in aggregates of two or more (Figs. 1 and 2), up to a maximum of nine nearly parallel lines, though the possibility of greater or smaller aggregates are not to be excluded.

Usually, small, elliptical or spherical, hollow or solid bodies of various dimensions were found dispersed between any two neighboring dense lines. They were never found on the side not bordered by another dense line. These small bodies bore some resemblance to and may very well be identical with the virus-like particles. In places they very closely approximate the dense lines, but this increased proximity might be artifactual, due to the angle of sectioning.

The origin, nature and function (if any) of these structures are not known. They were only seen in *Drosophila* that were 40 days or older, and only in those cells which were infested with virus-like particles, suggesting a possible link with the virus-like particles. Even though these unusual structures occurred only in a very few individuals, they were present in enough cases to warrant description.

ACKNOWLEDGEMENTS

I wish to thank Dr. B. P. Sonnenblick of Rutgers University, Dr. H. J. Sobel and Mr. E. Marquet of the Beth Israel Hospital for their interest and encouragement, and Dr. D. V. Provenza for reviewing the manuscript.

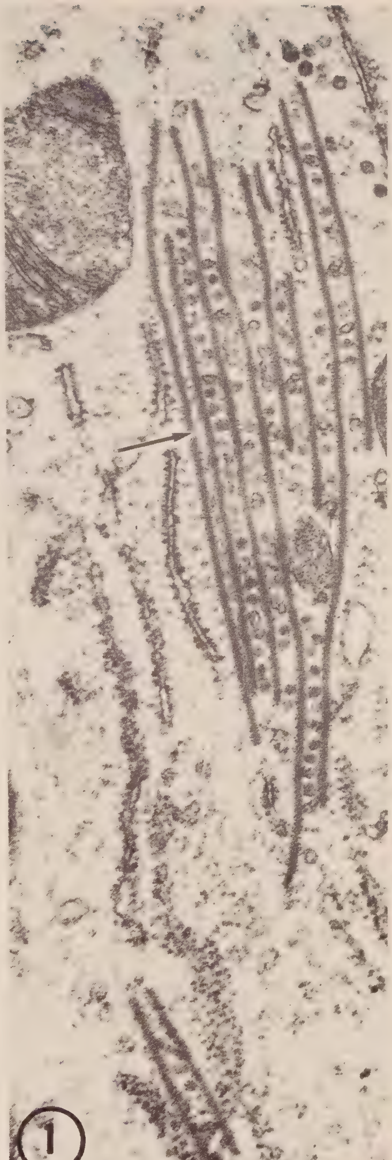

FIGURE 1
Dense lines of specific periodicity (arrow) in the midgut of an old *Drosophila*.
X36,000

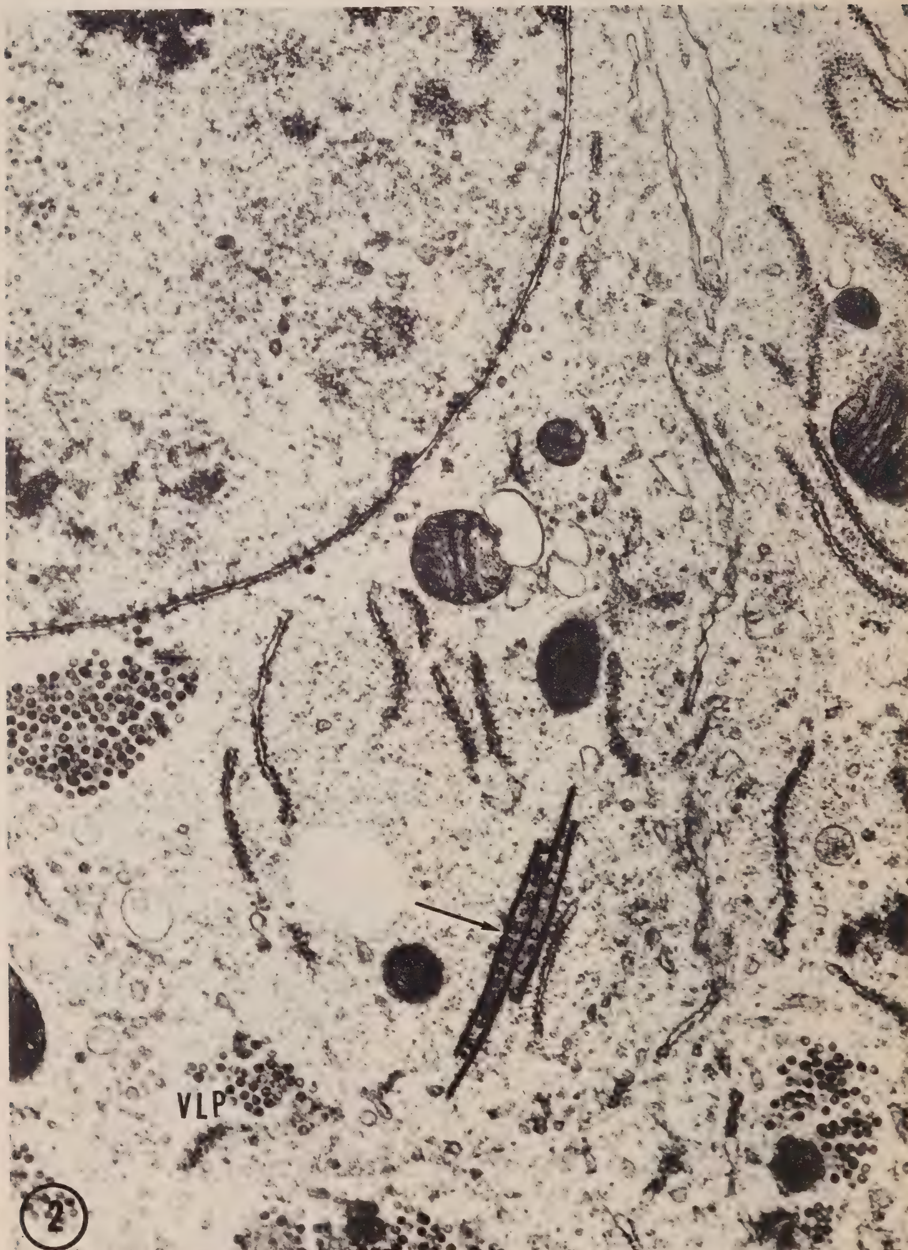

FIGURE 2
Virus-like particles (VLP) and dense lines in the midgut of old *Drosophila*. Arrow points to hollow particles between the dense lines.

X26,300

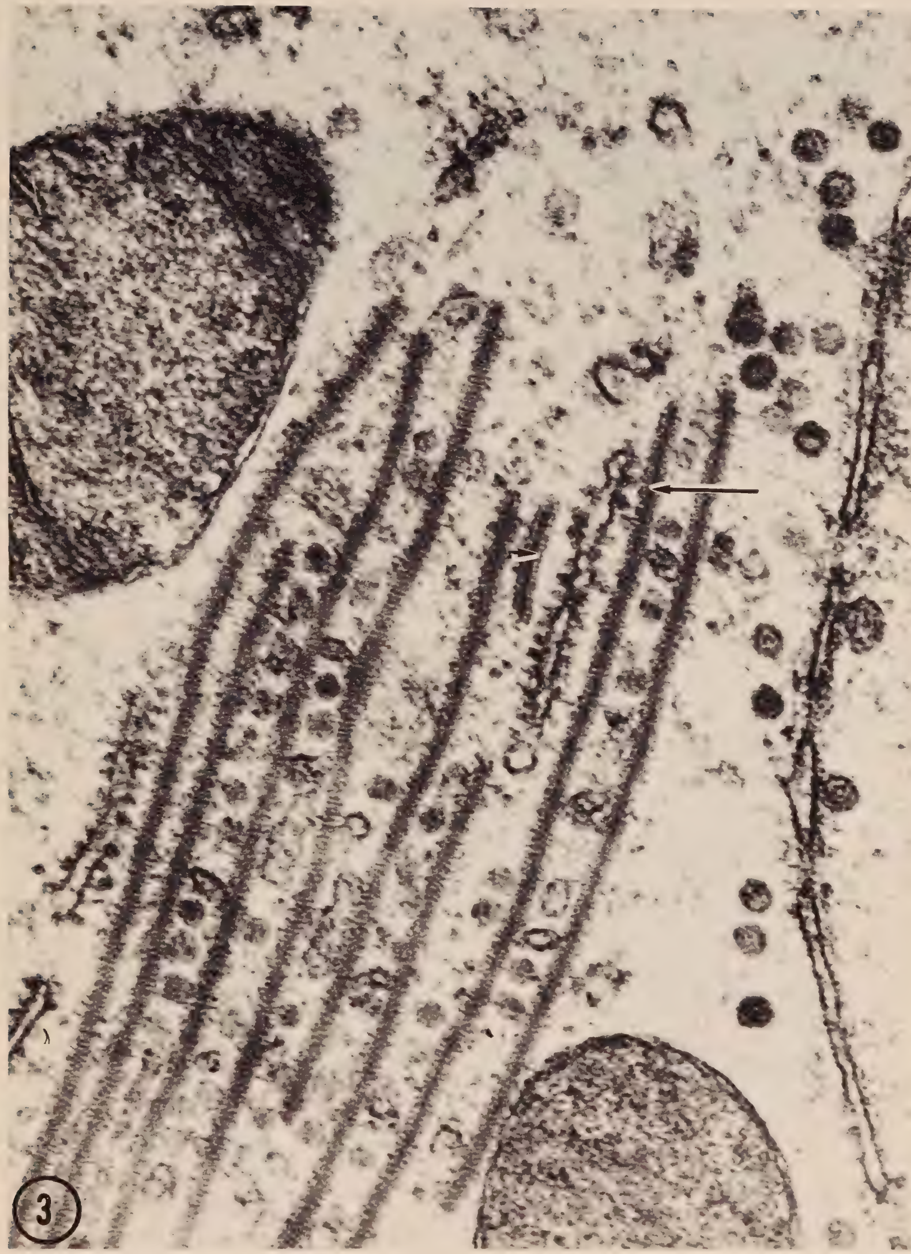

FIGURE 3
Higher magnification of part of Figure 1 illustrating the periodicity (arrow) and dense central core (arrowhead).

X76,000

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Format Recommendations For Contributors

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Two complete manuscripts with illustrations should be sent to the Editor, Journal, Baltimore College of Dental Surgery, University of Maryland School of Dentistry, Baltimore, Maryland, 21201. The articles which are submitted for publication are expected to follow the format suggested below. It is assumed that the papers are based on original data and that they have not been published or previously submitted for publication in other Journals.

II. Text Sections

Each article should be sequentially arranged as follows:

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B. Introduction
C. Materials and Methods
D. Results
E. Discussion
F. Acknowledgements
G. References

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References cited in the text should include the author(s) last name and publication year as in "Doe and Brown (1966)". Multiple authorship (more than 2) is initially cited *in toto.* e.g. Doe, Brown and White (1966). Subsequent reference to the multiple authorship (more than 2) should be made as: Doe, *et al.*, (1966).

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CONTENTS

Comparison of Dental Health Profiles of Two Women's Prisons[1]

STEWART SHAPIRO, D.M.D., M.Sc.H.*, DOROTHY E. GALLANT, B.A.**
BURTON R. POLLACK, D.D.S., M.P.M.***

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Comparison of Dental Health Profiles of Two Women's Prisons[1]

STEWART SHAPIRO, D.M.D., M.Sc.H.*, DOROTHY E. GALLANT, B.A.**
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INTRODUCTION

Dental researchers are constantly seeking closed populations in which epidemiologic studies may be conducted with adequate control of participants. Smaller samples can be selected from the target population by statistical technique to formulate hypotheses related to the general population before initiation of large scale longitudinal studies. Consideration of a pilot study involving a closed-panel population may be indicated to evaluate the feasibility, administration, and mechanics of a proposed epidemiologic project. This report directs attention towards prison inmates, particularly female, as a research source.

Shapiro, et al, [1 6] have evaluated long-term correctional institutions and detention centers as sources for oral epidemiologic studies and have reported descriptive data of dental findings of residents of various correctional institutions. Such populations are unique in possessing similar living habits, in addition to being isolated within a "well-defined area." The regimentation of a prison environment is conducive to reporting, examination, and similarity of daily activity. In prison centered longitudinal studies, accommodation for emigration and immigration of subjects can be accomplished successfully. Prison inmates move in either direction as determined by legal procedures on a prescheduled basis.

It is the intention of this report to further validate the suggestion of a prison population as a potential source for future oral epideniologic studies.

METHODOLOGY

The institutions selected for comparison of the oral health profile of incarcerated females, were (1) the Correctional Institution for Women in Framingham, Massachusetts and (2) The Maryland Correctional Institution for Women in Jessups, Maryland. Both institutions have similar numbers of residents, plus rehabilitative programs and facilities which are similar in administrative policy.[7] The geographic areas in which they are located constitute the major difference.

Dental examinations were conducted on all inmates in residence at each institution at the time of the study. The oral examinations were conducted in prison dispen-

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1 Presented at the 49th General Session of the International Association for Dental Research

saries as scheduled by the dispensary nurses. Dental findings were recorded on standard dental field survey forms. The form provides for recording the D.M.F.T. scores (Decayed, Missing, and Filled Teeth)[8], the P.I. scores (Periodontal Index—Russell)[9] (Table I) and O.H.I. scores (Oral Hygiene Index —Simplified—Greene and Vermillion)[10] (Table II) for individual teeth, and is designed for interpretation and analysis by optical scanning equipment. This report will present comparative dental findings using all three of these indices.

The examinations were conducted with the use of mirror, explorer, and adequate illumination. Radiographs were not taken. The examinations were performed to determine the status of 28 teeth, the third molars not being included. Since no radiographs were taken, the difficulty that would confront the investigators in determining accurate classification for any missing third molar teeth was eliminated. This would also control for overestimation of the missing tooth component.[11] One examiner completed all the oral examinations. Only subjects with at least two natural teeth at the time of the examinations were included in the periodontal portion of the study.

RESULTS

In Maryland, examinations were conducted on 156 subjects. Ten women were not included for periodontal evaluation, since they did not meet the criterion of two natural teeth.

The mean age distribution for the 156 residents (included in the D.M.F.T. phase of the study) was 28.54 years, with a standard deviation of 9.82 years. The mean age distribution for the 146 subjects evaluated for the periodontal portion was 27.32 years, with a standard deviation of 8.65 years. The non-white to white racial ratio was approximately 2.5 to 1.

In Massachusetts, dental examinations were completed for 116 female inmates. This did not comprise the entire resident population of 128, since 8 were in administrative isolation and 4 declined to participate in the study. The mean age distribution for the 116 subjects (included in the D.M.F.T. phase) was 31.01 years, with a standard deviation of 12.47 years. The mean age for the 93 subjects satisfying the criteria for the periodontal portion of the study was 28.05 years with a standard deviation of 10.31. The white to non-white racial ratio was 2.2 to 1.

There were no statistically significant differences in age between the two populations.

Stratification and comparison of both populations by five-year age intervals, starting at 16 years of age, were completed for the age specific mean D.M.F.T., P.I. and O.H.I.-S. Scores.

The 21-25 year age group presented the only significant difference for mean D.M.F.T. Scores (Table III). For this age group the Massachusetts residents have a mean D.M.F.T. Score of 20.29 in contrast to 15.43 for their Maryland counterparts. Although the mean D.M.F.T. Scores were generally greater for the Massachusetts residents, the differences were not statistically significant at the 95% level except for the 21-25 year old group. In both study popu-

lations there was an overall increase in mean D.M.F.T. Scores with advancing age. Although the values are not presented in tabular form in this report, the increase in D.M.F.T. Scores was due primarily to the consistent increase of the *missing tooth* component.[5 6]

Massachusetts residents demonstrated higher levels of periodontal disease (Table IV). The 21-25 and 26-30 year old age groups in Massachusetts presented significantly greater Periodontal Index Scores than the corresponding Maryland subjects. The trend of increasing periodontal disease with advancing age was seen in both study populations. There was a trend for lower levels of oral hygiene in all age groups of Massachusetts subjects, as compared to the Maryland population (Table V). However, a statistically significant difference (95% level) was found only in the 26-30 year old age group. This finding is most interesting since statistical differences in periodontal scores were observed in the inclusive 21-30 year old age group.

DISCUSSION

The similarity between the oral health profile of non-institutionalized females, [12 16] and females in residence in long-term correctional agencies has been documented in previous reports.[1 6] This study has compared the dental findings of incarcerated females in two geographically distinct institutions. The racial composition of the two institutions were diametrically opposed, the Massachusetts population contains over twice as many (2.2:1) white than non-white females with an almost converse distribution in the Maryland institutionalized population (1.2:2). If the results were statistically different at all age levels, then perhaps the difference could be explained by the racial distribution in either population. This is not the case, as only the 21-25 year old age level was consistent in significant differences in mean D.M.F.T., O.H.I.-S. and P.I. Scores. The Massachusetts prisoners exhibit higher age specific mean Scores for all the indices used to measure the status of oral health. These findings are consistent with those of the National Health Survey which reports health profiles on a regional basis.

CONCLUSIONS

1. There is a similarity between health findings of females in residence in two geographically distinct correctional institutions.
2. There was a greater prevalence of dental disease in the Massachusetts residents as compared to their Maryland counterparts. However, the differences were not statistically significant.
3. The similarity of such dental health findings in two different states, which is in agreement with the data in the National Health Survey, supports the recommendation for considering such populations as available sources for dental research.
4. Investigators utilizing populations in different geographic regions should account for all differences, whether they be statistically significan or not, in all analytic or experimental studies.

TABLE I: CRITERIA FOR THE PERIODONTAL INDEX

Score

0 NEGATIVE

There is neither overt inflammation in the investing tissues nor loss of function due to destruction of supporting tissues.

1 MILD GINGIVITIS

There is an overt area of inflammation in the free gingivae, but this area does not circumscribe the tooth.

2 GINGIVITIS

Inflammation completely circumscribes the tooth, but there is no apparent break in the epithelial attachment.

6 GINGIVITIS WITH POCKET-FORMATION

The epithelial attachment has been broken and there is a pocket (not merely a deepened gingival crevice due to swelling in the free finfivae). There is no interference with normal masticatory function; the tooth is firm in its socket, and has not drifted.

8 ADVANCED DESTRUCTION WITH LOSS OF MASTICATORY FUNCTION

The tooth may be loose; may sound dull on percussion with metallic instrument; may be depressible in its socket.

RULE: When in doubt, assign the lesser score.

Ref: J. Dent. Res. 35:350-9. 1956

TABLE II: COMPONENTS OF THE SIMPLIFIED ORAL HYGIENE INDEX

A. *Scores and Criteria for Oral Debris*

0—No debris or stain present.

1—Soft debris covering not more than one-third of the tooth's surface, or the presence of extrinsic stains without other debris regardless of the area of surface covered.

2—Soft debris covering more than one-third, but not more than two-thirds of the exposed surface of the tooth.

3—Soft debris covering more than two-thirds of the exposed surface of the tooth.

B. *Scores and Criteria for Oral Calculus*

0—No calculus present.

1—Supragingival calculus covering not more than one-third of exposed surface of the tooth.

2—Supragingival calculus covering more than one-third, but not more than two-thirds of the exposed surface of the tooth or the presence of individual flecks of the subgingival calculus around the gingival portion of the tooth or both.

3—Supragingival calculus covering more than two-thirds of the exposed surface of the tooth or a continuous heavy band of subgingival calculus around the gingival portion of the tooth or both.

Ref: J.A.D.A. 68:7-13. 1964

TABLE III

Comparison of DMFT (Decayed, Missing, Filled Tooth) Scores for residents of the Massachusetts Correctional Institution and the Maryland Correctional Institution for Women, beginning at 16 years of age, by five year intervals.

	MASSACHUSETTS		MARYLAND		
Age Interval	*No. of Subjects*	*Mean DMFT*	*No. of Subjects*	*Mean DMFT*	*95% Level of Significance*†
16–20	21	13.81 (1.11)*	32	11.47 (0.95)	N.S.‡
21–25	34	20.29 (0.89)	42	15.43 (0.88)	Significant
26–30	15	18.93 (1.09)	31	17.39 (1.01)	N.S.
31–35	13	20.69 (1.78)	18	18.44 (1.46)	N.S.
36–40	8	20.12 (1.87)	13	19.08 (1.91)	N.S.
41–45	7	23.29 (1.87)	10	19.70 (1.24)	N.S.
46–50	6	24.33 (1.96)	4	26.75 (1.25)	N.S.
51–55	4	23.75 (4.25)	3	22.67 (2.90)	N.S.
56–60	4	23.25 (4.75)	1	26.00 (0.00)	N.S.
61–65	4	24.50 (2.06)	2	28.00 (0.00)	N.S.
	116		156		

* Standard Error of Mean

† "t" test

‡ non-significance

Table IV

Comparison of P.I. (Periodontal Index) Scores for residents of the Massachusetts Correctional Institution and the Maryland Correctional Institution for Women, beginning at 16 years of age, by five year intervals.

	MASSACHUSETTS		MARYLAND		
Age Interval	*No. of Subjects*	*Mean PI*	*No. of Subjects*	*Mean PI*	*95% Level of Significance*†
16–20	21	1.47 (0.15)*	32	1.08 (0.13)	N.S.‡
21–25	30	2.41 (0.33)	41	1.46 (0.16)	Significant
26–30	14	2.88 (0.37)	30	1.56 (0.27)	Significant
31–35	10	2.38 (0.31)	18	1.80 (0.54)	N.S.
36–40	7	2.28 (0.81)	11	2.46 (0.78)	N.S.
41–45	4	3.97 (0.74)	8	3.75 (1.00)	N.S.
46–50	3	4.96 (1.50)	3	0.50 (0.57)	N.S.
51–55	1	1.33	2	2.27 (2.22)	
56–60	1	2.20	1	1.67	
61 65	2	2.59 (2.60)	0		
	93		146		

* Standard Error of Mean
† "t" test
‡ Non-significance

TABLE V

Comparison of OHI-S (Simplified Oral Hygiene) Scores for residents of the Massachusetts Correctional Institution and the Maryland Correctional Institution for Women, beginning at 16 years of age, by five year intervals.

MASSACHUSETTS			MARYLAND		
Age Interval	*No. of Subjects*	*Mean OHI-S*	*No. of Subjects*	*Mean OHI-S*	*95% Level of Significance†*
16–20	21	1.67 (0.16)*	32	1.10 (0.20)	N.S.‡
21–25	30	2.59 (0.24)	41	1.34 (0.14)	N.S.
26–30	14	3.06 (0.21)	30	1.20 (0.18)	Significant
31–35	10	2.51 (0.21)	18	1.62 (0.36)	N.S.
36–40	7	2.68 (0.34)	11	2.01 (0.59)	N.S.
41–45	4	3.13 (0.39)	8	1.77 (0.42)	N.S.
46–50	3	3.00 (0.76)	3	1.00 (1.15)	N.S.
51–55	1	2.00	2	1.05 (1.19)	
56–60	1	30.7	1	3.34	
61–65	2	4.35 (1.15)	0		
	93		146		

* Standard Error of Mean

† "t" test

‡ non-significance

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The Temporomandibular Joint As Related To Orthodontic Treatment

Marvin M. Graham,* A.B., D.D.S., A.M., F.A.C.D.

J. Baltimore Coll. Dent. Surg. 26(2) 1971

The Temporomandibular Joint As Related To Orthodontic Treatment

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The morphologic structure of the temporomandibular joint accommodates functional normal patterns or acceptable adaptable patterns of movements of the mandible within certain limits. These movements are activated by the muscles involved and can be harmonious and well integrated or altered and yet not be coordinated as a result of the dynamic anatomical relationship of the teeth in their contacting positions in function.

It is important to realize the structural and functional requirement of each part of the "closed system," the stomatognathic system comprising (1) joint, (2) muscles and (3) teeth and attachment apparatus. Each part can adapt to various altered patterns of movement of the mandible or can show either or both alterations in structure and in function that may bring about pathological changes. These changes may be specific to the joint (degenerative arthritis, osteoarthritis, etc.) or to the muscles (spasm, contracture, etc.) or to the periodontium and the teeth (collapse of dental arch, occlusal traumatic lesions, etc.). They may affect any possible combination of the parts or the total stomatognathic system.

Some practical clinical aspects of the anatomy and physiology of the temporomandibular joint and the muscles of mastication should be reviewed, as well as the position and movements of the mandible as the teeth articulate while the jaws relate in function discussed.

The Temporomandibular Joint

The temporomandibular joint is architecturally well designed for its function. (Fig. 1) The articulating surfaces are covered by an avascular fibrous cartilage in two basic layers well adapted to withstand the forces and stresses of mastication. Anatomically, the mandible connects the right and left temporomandibular joints, and this anatomical relationship causes the two joints to be dependent upon each other in their movements. The alveolar process of the mandible and maxilla support the teeth; and as the jaws relate, the contacting incline planes of these teeth can definitely effect the movements of the joints. The temporomandibular joint is divided both anatomically and physiologically into an upper and lower chamber by a dense, firm, avascular fibrous plate (the articular disc) interposed between the temporal bone and mandible. The upper chamber

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Read before the Middle Atlantic Society of Orthodontists, Atlantic City, New Jersey.

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exists between the articular disc and the temporal bone, and accommodates translatory or gliding movements (arthrodial), while the lower chamber between the condylar head and the articular disc accommodates pure rotatory or hinge movements (ginglymoid). Therefore, this ginglymo-arthrodial joint can be described as a moving ball and socket, a dual joint, with two basic movements, rotatory and translatory. The various combinations of these two basic movements that occur in both the right and left temporomandibular joint when activated by the musculature, produce functional movements. The positional relationship of fossa, articular disc and condyle, the inclination and curvature of the posterior slope of the articular eminence, and the direction and attachment of the vertical components of the elevator and retractor muscles of mastication account for the terminal hinge position or centric relation. Movement limitation of the temporomandibular joint is due to a combination of (1) bony "stops" (the posterior articular lip or medial articular lip of the temporal bone), (2) the fibrous capsule of the temporomandibular joint and the temporomandibular ligament and (3) the protective contraction of the external pterygoid muscle. The thick, loose area of blood vessels and connective tissue posterior to the articular disc by emptying when engorged with blood, may resist compression posteriorly and superiorly.[1] However, a retrusive posterior-superior movement from terminal hinge position can normally vary between 0 to 1.5 mm. possibly accounting for part of the long centric range to which many individuals functionally adapt without pathological changes affecting the stomatognathic system. The variations in the shape and in the horizontal and vertical inclination of the condyle in relation to the ramus of the mandible govern its eminence relationship in functional movements. When considered with the restricting action of the temporomandibular ligament these factors become most important in dictating the Bennett shift and require accurate relation of interdigitating teeth during the most powerful phase of the chewing cycle. It would be interesting to speculate whether the small percentage of individuals that exhibit no Bennett shift would correspond with the 3 per cent that have completely round shape condyles[2] able to rotate without a side to side shift in order to clear anatomical stops.

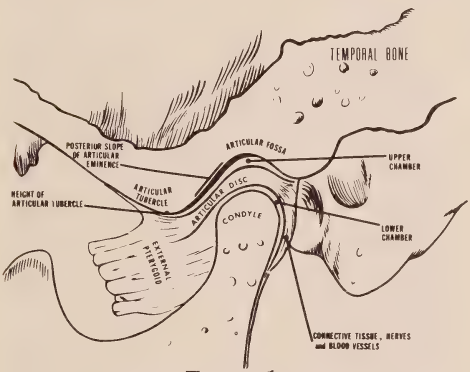

FIGURE 1

The Temporomandibular Joint. The articular disc divides the joint anatomically and physiologically into an upper and lower chamber. Note that the external pterygoid can protract the articular disc. No muscular retraction of the disc is present.

It is also interesting to note that the fibrous capsule of the temporomandibular joint as well as the temporomandibular ligament is at-

tached between the temporal bone and the periphery of the articular disc to allow for a translatory movement in the upper chamber, but more firmly attached between the periphery of the articular disc and the neck of the condyle in the lower chamber to allow only hinge or rotatory movements. There is no muscular retractor of the disc which therefore follows the condyle passively posteriorly-superiorly due to the attachments of the ligaments when the mandible is retracted by the muscular retractors (elevators). The external pterygoid muscle does protract the disc. This anatomical arrangement, when not functioning harmoniously, can cause a change in condyle-disc alignment, and may be the cause of certain clicking sounds and also may lead to subluxation of the lower chamber of the temporomandibular joint.[3]

The Muscles of Mastication

The three muscles of mastication (masseter, temporal, internal pterygoid) that function in a vertical direction are illustrated in figures 2, 3, and 4. These muscles act mainly to elevate the mandible. The fibers of the deep portion of the masseter and the posterior fibers of the temporal are also capable of retracting the mandible from its protrusive position. Due to the proximity of the insertion of the internal pterygoid and temporal muscles in the mandibular third molar region, eruption of these teeth can affect the tone of the muscle fibers and therefore their function.[3] (Fig. 4) A careless mandibular injection into this region may bring about the same result.

The fourth muscle of mastication, the external pterygoid, protracts the mandible symetrically or asymetrically in lateral excursions.[4] (Figures 3 and 5) It is a difficult muscle to palpate and to inject. It is frequently involved in functional disturbances of the temporomandi-

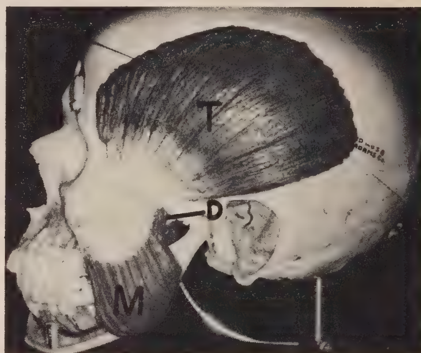

FIGURE 2
The Masseter (M) and the Temporal (T) Muscles. The direction of the superficial fibers of the masseter (M) is downward and backward. The fibers of the deep bundle (D) of the masseter run directly downward. Note the direction of the anterior, middle and posterior fibers of the temporal (T) muscle.

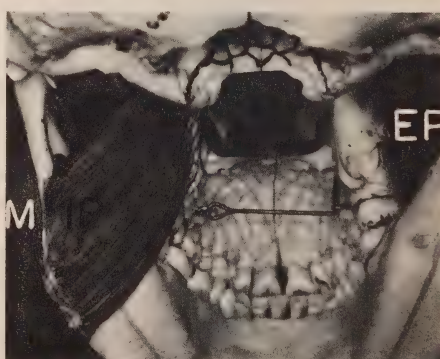

FIGURE 3
The internal pterygoid (IP) fibers run downward, outward and backward and anastomose with fibers of the masseter (M). Note the horizontal direction of the fibers of the external pterygoid (EP).

bular joint, and spasm of some of its fibers usually results in clicking or crepitus of the joint.

During typical deglutition it is necessary for the mandible to be fixed. This is normally accomplished by the elevators contracting and the teeth contacting.[5] This occurs about 40 times an hour, thus continuously re-enforcing the path of closure whether a normal centric

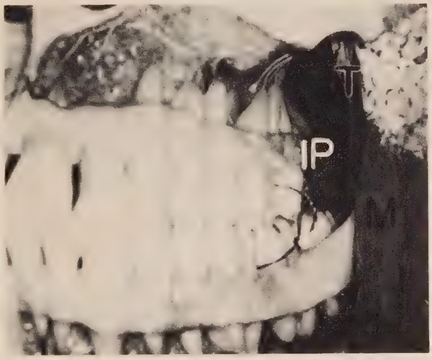

FIGURE 4
Relationship of the masseter (M), the superficial tendon of the temporal (T), and the internal pterygoid muscles (IP).

FIGURE 5
The External Pterygoid (EP). Note the horizontal direction of the fibers of the larger inferior belly (I) and the smaller superior belly (S). Contraction of these fibers will move the condyle and disc downward, forward and inward on the posterior slope of the articular eminence.

dynamic path or a habitual eccentric one. It is therefore necessary at times to use a bite guard to eliminate the secondary acquired reflex in order to remove the deflecting contacts and the damaging effect of bruxism.

In pure terminal hinge rotation, the muscles of the suprahyoid group depress and retract the mandible while the elevators and the external pterygoids relax. The slightest contraction of the external pterygoids would cause some translation. This accounts for the difficulty in directing some patients to rotate in terminal hinge position and also explains the reciprocal inhibiting effect produced by the terminal hinge exercise utilized in treating spasm of the external pterygoid muscles in temporomandibular joint dysfunction.[6]

Discussion of Muscle Spasm

The functional unit of striated muscle is the motor unit comprised of a nerve fiber whose cell body is in the anterior horn of the spinal gray matter and whose terminal branches end in a various number of muscle fibers.[7] The all or none law implies that each motor unit will respond maximally or not at all. Since a muscle has many motor units, the amplitude of contraction is increased by the recruitment of more units into function which results in a gradation of response. Parts of any one muscle may and do act independently and may act synergistically with different muscles at different times. The reaction of a muscle to noxious stimulus is to go into spasm which is to shorten beyond its physiologic limit in an attempt to protect itself against injury. The cause may be

any one or a combination of noxious stimuli such as trauma, occlusal disharmonies, infections, etc. The muscle in spasm resists passive stretching and loses its capacity for voluntary relaxation.[8] Parts of any one muscle may go into spasm which not only affects normal muscle length and function, but causes pain.

Symptoms of Myospasm

A spasm-pain-spasm chain reaction may occur as the muscle tries to adapt in order to maintain function not only by itself but in coordination with its synergist and antagonist. This pathophysiological process synergizes, effecting more motor units in the agonist-antagonists increasing and remaining long after the original, causing noxious stimulation. The resulting symptoms may include not only pain varying from a dull ache to one of great intensity, but also clicking and grating sounds in the temporomandibular joint, limitation of opening of the mouth, deviation and incoordination of motion. Fortunately, with proper treatment, the spasm can be completely alleviated and the muscle returns to normal length and function.[8]

Relation of Occlusion to Temporomandibular Dysfunction

The etiological factors in a large majority of the cases causing a pain-dysfunction syndrome of the temporomandibular joint appear to be involved with the relation of the dental arches as the incline planes of the teeth support and move over each other in centric hold position and in excursive movements during mastication. As the mandible closes from a lateral position during the powerful force of mastication through the bolus of food, the upper and lower teeth must interdigitate properly to be harmonious with the Bennett shift as the working side condyle rotates and glides medially supported and braced against the posterior slope of the temporal eminence. The forces are thereby distributed, as designed by an anatomic "architectural" plan, vertically in the long axis of the teeth with adequate attachment apparatus and supporting bone, and to the temporomandibular joint in a dynamic centric relation closing path that can properly function in its support to the action.[9] The muscular contraction is rhythmic, coordinated and harmonious and results in a well balanced healthy system.

Physiologic and Pathologic Dislocations

As stated previously, all functional movements of the mandible are a combination of the two basic movements, and therefore there are various degrees of rotation and translation whenever the mandible is opening. More translation then rotation occurs in Angle's Class II occlusions, while in Class III occlusions one finds little translation and more rotation in the opening movements. In Class I occlusions there appears to be relatively the same amounts of each basic movement. In most cases during opening (Class I and Class II cases) the condyle is at the height of the articular eminence or anterior to it (especially Class II cases), and therefore completely out of the articular fossa.[10] This can be considered a physiologic dislocation since the individual can return to centric relation without outside help.[4]

Normal harmonious, neuromuscular coordination will smoothly close this physiologically dislocated mandible without any clicking sounds. The external pterygoid which holds the condyle forward must relax first; then the retractors must return the condyle to the posterior slope of the articular eminence (past the height of the eminence and into the articular fossa) before the powerful elevators contract.

The lack of neuromuscular coordination between agonist and antagonists will result in either a complete pathological dislocation (due to the contraction of the elevators before the condyle is returned onto the posterior slope) or a clicking, incoordinated closing pattern occurring at the start of the closing movement (due to a delay in relaxation of the external pterygoid or activation of retractors before the elevators contract). This physiologic click and the more severe pathologic dislocation can result from muscle spasm brought about by the disturbing relation of the inclined planes of teeth articulating in function after they have been repositioned during orthodontic treatment.

Guidelines for a Functional Occlusion

There are certain guide lines used in fabricating an occlusion prosthetically or in attempting to align a morphologic occlusion orthodontically. In any quadrant, the centric supporting cusp tips (the buccal cusps of the lower and the lingual cusps of the upper) contact marginal ridge areas with two exceptions: (1) the distal-buccal cusps of the mandibular molars articulate in the central fossa areas of the maxillary molars, and (2) the mesial-lingual cusps of the maxillary molars articulate with the central fossa areas of the mandibular teeth. When one applies the concept that the occlusal position of teeth must harmonize with centric jaw relation, not only is a positive centric occlusion developed but the mandible is allowed to move to and from centric occlusion without restraint during function. The working cusps interdigitate and glide through opposing marginal ridges and fossae. The incline planes on the balancing side (the inner aspect of the lingual cusps of the upper and the inner aspect of the buccal cusps of the lower) glide without interference over each other either barely contacting or completely out of occlusion. This principle is utilized in the unilateral concept of occlusion.

When orthodontic treatment is initiated, a dental equilibrium is changed from one that in many cases has a physiologic occlusion and a morphologic malocclusion to one that should result in a morphologic and a physiologic occlusion. The teeth must not only be aligned but so must their inclines, and all must be in harmony with the muscles and the temporomandibular joints. This does not imply that function is normal only if classic concepts of occlusion are in effect. There should exist a rhythmicity and continuity of the dental arches so that the marginal contacts of the teeth brace and support each other. What can happen when the first premolars are extracted and all marginal contacts cannot be reestablished? What can happen when a late pubertal growth of a boy's mandible occurs after the maxillary arch has been fixed.[11]

What can happen when cuspal inclines, improperly related, cause a posterior or anterior displacement of the mandible? These and other problems can affect any or all parts of the stomatognathic system and cause the various symptoms discussed previously. In most cases, it results in prolonged use of orthodontic retainers followed by collapse of the dental arches when the retainers are removed. If the teeth are moved to a proper alignment and an optimum plane relation is established, stabilization can be facilitated by a careful, judicious selective grinding technique, rendering the best possible service to the patient. (Figs. 6-11) Selective grinding should be a part of routine orthodontic care to insure successful treatment that will not cause symptoms and pathologic changes in later years.

Conclusion

The attempt to correlate and integrate proper jaw relationship by selective grinding of incline planes of contacting teeth in the final stages of orthodontic treatment would not only help to obviate a significant problem, but would shorten the time of treatment and help to assure a more successful result.

CASE HISTORY

Cl. II Div. I—Protrusion and some spacing of maxillary anteriors with crowding of mandibular anteriors. Orthodontic treatment started August, 1962 with extraction of maxillary and mandibular 1st bicuspids right and left, and banding of all teeth. Appliances removed and tooth positioner placed in mouth, May, 1963. Patient was not a conscientous wearer of tooth positioner; therefore a bite plate was made in October, 1963.

In February, 1967, the bite seemed to be opening in the bicuspid region, and the occlusion was more predominant in the 2nd molar region than other teeth. The patient was clicking in both temporomandibular joints during function (chief complaint) and was referred to equilibration. A 1½ mm slip to right lateral was present from the patient's centric relation (terminal hinge position) to occlusal position (maximum occlusion).

A hinge axis-master chart selective grinding technique was used in equilibrating and reshaping the relationship of the incline plans during function. Centric occlusion was stabilized and the mandible was free to move to and from centric occlusion. All clicking disappeared within a week, and the esthetic and functioning occlusion was not only considerably improved, but stabilized to date.

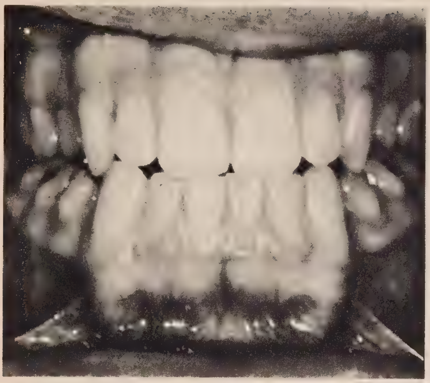

FIGURE 6

FIGURE 7

FIGURE 8

FIGURE 9

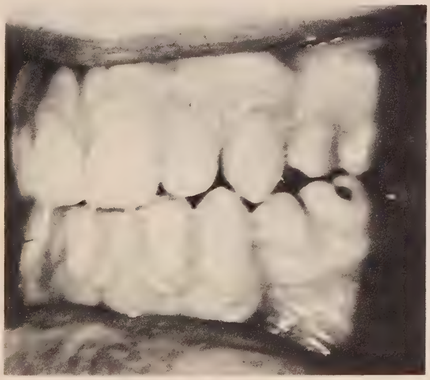

FIGURE 10

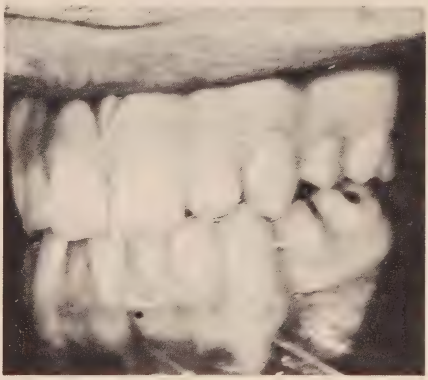

FIGURE 11

LEGEND

Fig. 6. Anterior view before selective grinding technique.

Fig. 7. Anterior view after selective grinding. Note the increase in vertical overlap and the relationship of the posterior teeth.

Fig. 8. Right view before selective grinding technique.

Fig. 9. Right view after selective grinding technique. Note the 2nd right maxillary bicuspid and the mesial buccal cusp of the 1st right maxillary molar were not able to be brought into an ideal relationship by a selective grinding technique. However, they functioned harmoniously in relation to the temporomandibular joints and could be further corrected orthodontically.

Fig. 10. Left view before selective grinding technique.

Fig. 11. Left view after selective grinding technique. The result anteriorly and on the left side was greatly improved by selective grinding.

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A Clinical Discussion for Successful Endosseous Blade Vent Implants

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A Clinical Discussion for Successful Endosseous Blade Vent Implants

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The dental literature of the past several years is extant with numerous articles dealing with oral implantology. The types of implants discussed vary from autogenous bone implants to endosseous metal implants 1, 2, 3, 4, 5, 6. The purpose of this paper is to discuss one type of implant, its indications, technique of implantation, prosthetic management, legal implications, and the experience of this writer relative to its use.

The endosseous blade vent implant is one in which a metal alloy is placed within the cancellous portion of the osseous structures comprising the maxilla and/or mandible. The metal oral implant has been brought to its present level of sophistication through the clinical techniques developed by many clinicians.[7] The ability to encase a piece of metal within living tissue without resulting in a significant foreign body reaction is the result of fabricating a biologically inactive metal alloy. Once an inert metal was developed that would not react with living tissue the environment for oral implantology was considerably improved and the imaginations of many therapists stimulated. Since the scope of this paper is limited to the endosseous blade vent implant all discussions of oral implantology will concern itself with this specific entity. Much of the material discussed is from this writer's own experience.

The use of metallic oral implants is an unpredictable therapeutic procedure. At this time there does not appear to be conclusive clinical or laboratory evidence substantiating predictability or long term results; therefore, the type of implant utilized and the indications for its usage makes case selection of paramount importance for success.

It appears, that of the endosseous type of metal oral implant, the blade vent (Fig. 1), has the greatest potential for success, provided the recipient site is optimum, and the technical procedures utilized to manipulate the tissue follow the most precise techniques.[8]

The blade vent by virtue of its large surface area, narrowness and small bulk, provides a large area of metal alloy to contact a large quantitative amount of osseous structure.

The broad antero - posterior length of the implant increases the amount of tortional force that the implant can resist. Because of its shape it is very rigid and resistant

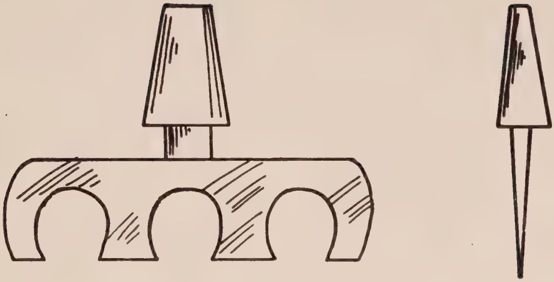


FIGURE 1
Blade Vent-endosseous metal implant

to deformation. The abutment post, which for all functional purposes becomes the clinical crown of the preparation, is well supported by the body of the implant which is encased within the bone. The blade vent gives the clinician a great deal of flexibility in design. An individual implant could be developed for a specific situation dependant upon the anatomy of the recipient site. The implant can be lengthened or shortened, either in an anterior-posterior, or superior-inferior direction. One or more abutment posts may be utilized, depending upon the morphology of the recipient site and the length of the body of the implant.

The most important decision which the therapist must make is case selection; this depends on definite criteria for this particular procedure. Since the procedure must be considered unpredictable, any other therapeutic procedure that would be predictable and produce the desired clinical result would be indicated before the utilization of an oral implant. Other therapeutic procedures also must be evaluated relative to their creating an iatrogenic situation within the dental organ system worse than the unpredictability of an implant. Assuming that all other procedures are deselected, then oral implants could be justified.

The patient must be informed of the procedure's unpredictable nature and the therapist should be well aware of its legal implications. The patient should sign a release in which the dentist is held free of damages resulting from utilization of the implant provided no mistreatment was performed. This statement should include the fact that the patient desires the procedure and that the individual patient has been informed of its unpredictability.

Release and Acknowledgement

This release and acknowledgement made this .... day of ...., 19 ...., between ...., hereinafter called "Patient", and Doctor ...., hereinafter called "Dentist", Witnesseth

WHEREAS, the patient desires the completion of a new dental procedure known as "blade implant" and, WHEREAS, the dentist is not willing to perform said procedure because of possible side effects from said procedure and demand first a release in his favor in consideration for rendering said procedure,

NOW, therefore this release and acknowledgment Witnesseth:

In consideration for the sum of One Dollar ($1.00), and other good and valuable consideration, receipt of which is hereby acknowledged, I ...... , hereby acknowledge that Doctor .... has fully explained to me both verbally and by diagram the proposed dental work to be done on me involving a procedure known as "blade implant". It has been explained to me that the doctor will insert in my maxilla and/or mandible (upper jaw or lower jaw) a piece of metal which will be driven into the bone, thereby permitting a tooth to be constructed around the implanted piece of metal.

I further acknowledge that it has been explained to me that there are certain risks involved in the procedure, some of which are a possibility of affecting the sinus, facial nerve involvement and some other side effects. It has further been explained that this procedure is not always perfect, in that the implant may later become loose. While normally such episodes do not occur, the doctor has refused to begin this procedure without my acknowledging that such possibilities can occur, although hopefully should not.

I further acknowledge that this instrument shall also serve as a release, as well as an acknowledgement in favor of the Dentist, their heirs and assigns, from any claim resulting from the "blade implant" which I have asked to have performed on me.

.... (Seal)

....
Witness

* I have read the above acknowledgement and release and certify that I understand and agreed to the above.

This procedure, being a surgical one, has a degree of physical and emotional trauma associated with it; however, it is a great deal less than one would expect. This assumes that the surgical technique is precise, and that the patient is in satisfactory physical and emotional condition to accept the procedure. There is less physical trauma associated with a blade vent implant than the majority of oral surgical procedures.

It is this writer's opinion that the most predictable site for an oral implant is the unilateral free end situation in either the maxilla or the mandible. More often the mandible will lend itself as an optimum site because of the absence of anatomic structures which would preclude the insertion of the implant beneath the crest of bone.

* To be copied in the releasor's handwriting

The dental organ system in the area of the implant should exhibit health, especially the periodontium. The proximal abutment teeth to the implant should have a good prognosis and exhibit a healthy periodontium. It is the proximal abutment teeth which in the final design of the restorative case will control the forces generated by the occlusion. Unilateral cases provide a greater margin of safety because the proximal abutment teeth can play a significant part in maintenance of the implant by controlling and dissipating occlusal force. The unilateral case lends itself to implant usage because other forms of therapy do not reduce the iatrogenic potential or restore the function as optimally to the edentulous area as a fixed member. The ultimate purpose of the oral implant is to act as a distal abutment to a fixed prosthesis. Its only purpose is to act as a stabilizing factor so that a fixed prosthesis may be fabricated to perform the function usually ascribed to teeth.

Not too much can be said about selection of the recipient site. Its morphology is tantamount to success. The shape of the ridge must approximate the shape of the implant or an individually designed implant must be fabricated. There must be sufficient space between the crest of the alveolar ridge and any anatomic structure which would interfere with subcortical placement of the implant. In the mandibular arch the inferior dental canal would be the most often encountered anatomic structure and in the maxillary arch, the sinuses. The location of these structures must be carefully considered relative to the placement of an implant. The ridge must have adequate depth facial-lingually and not be "knife-edged." Knife edged ridges tend to result in breaking the buccal or lingual plate of bone because they do not allow adequate room for creation of the receptor groove. Emphasis must be placed upon the tone of the tissue and the amount of attached gingiva over the ridge. If no keratinized masticatory mucosa is present over the ridge that is to receive the implant, the tissue will be unable to resist the "usual" trauma associated with those structures adjacent and subjacent to teeth. The osseous configuration of the bone must not be so dense that it would be too difficult to penetrate and have no elastic qualities. These qualities help maintain the position of the implant. The consideration of the above factors relative to the recipient site of the implant is conducive to its successful reception and maintenance.

The technique employed and the finesse of the therapist cannot be over emphasized in potentiating the success of the implant. Prior to the manipulation of the tissue, a local anesthetic with vaso-constrictor to reduce bleeding is subperiosteally infiltrated throughout the surgical area. There is usually no need for block anesthesia. An incision through the tissue to the crest of the bone is made over the midline of the receptor site the length anterior-posteriorally of the blade vent. (Fig. 2). Vertical releasing incisions are made at the proximal and distal for ease in elevating the muco-periosteal flap. (Fig. 2). A muco-periosteal tissue flap is raised the anterior-posterior length of the blade vent facially and lingually in order to visualize the underlying osseous structures.

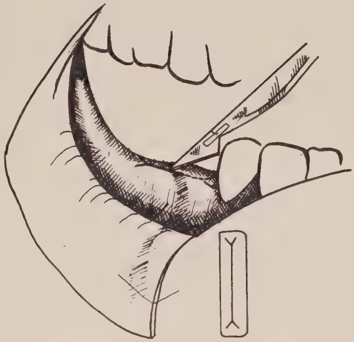
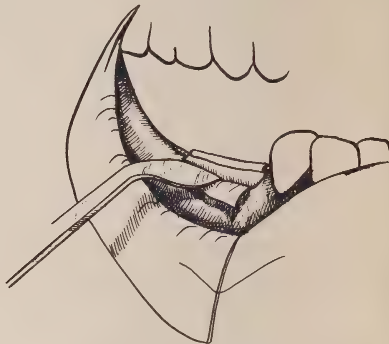


FIGURE 2



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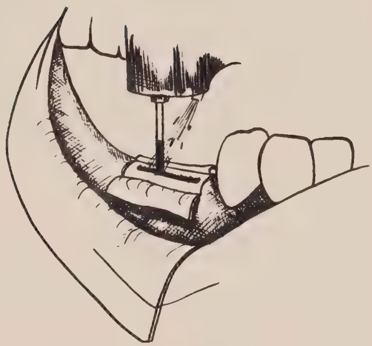
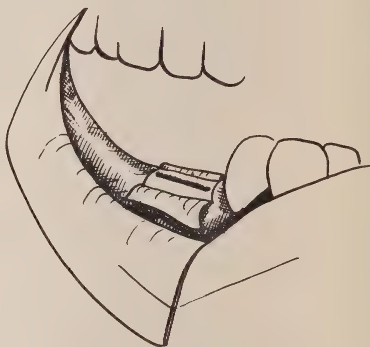


FIGURE 4



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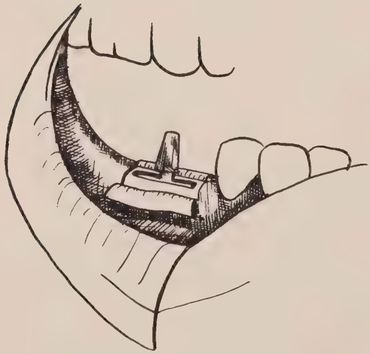

FIGURE 6

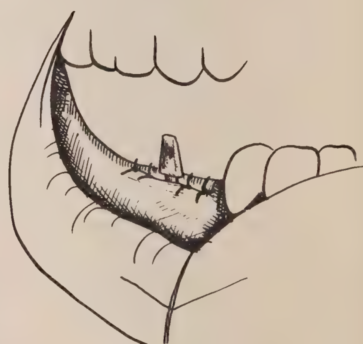

FIGURE 7

After retracting the facial and lingual tissue flaps the bone of the receptor site is visualized. A groove the length anterior-posteriorally of the implant is made over the center of the ridge to the depth of the implant with a bone burr 1.00 to 1.25 mm. in thickness. This allows the implant to be seated without undue trauma from malleting. The blade vent is then seated in the groove and gently malleted sub-cortically. The tissue flaps are coapted and sutured. Provided the surgical manipulation is precise, no significant trauma occurs. The importance of seating the implant subcortically cannot be over emphasized. If the metal is left above the crest of the bone it can become a tissue irritant causing the wound to fail to close by "first intention", or it will create an inflammatory reaction that will result in the wound epithelializing and exfoliating the implant.

Once the surgical procedure has been completed post operative management becomes important. The use of simple analgesics is usually sufficient to control pain. Ice to the surgical site and a post oral surgical diet is indicated. The use of antibiotics pre and post operatively seems to be accepted by the majority of clinicians. The substantiation for the use of antibiotics appears to be somewhat empirical at this time, but this clinician feels they should be used.

Following healing, which occurs in two or there weeks, the implant is ready to receive its prosthetic overcasting. There is no need to stabilize an endosseous implant upon its insertion. Any mobility in the implant would indicate it is a very poor candidate for success. Once healing has occurred and there are no clinical signs of mobility or inflammation, the implant area should be "provisionalized" for a minimum period of three to six months. This will allow the therapist to evaluate complete healing in the recipient site and the ability of the implant to withstand masticatory loads that will be placed upon it or any other forces generated within the dental organ system.

The design of the provisional splint should incorporate all those factors that are conducive to the maintenance of the area and an optimum physiological distribution of force. It should be a perfect facsimile of the final restoration. The factors of consequence to be considered in the provisional splint are the occlusal scheme, the contours of the clinical crown, pontic area, and embrasure space.

The occlusal scheme should be one that will dissipate the forces generated by the contact relationship of the inclined planes of the teeth in the most physiological fashion that is acceptable to the periodontium. The proximal abutment teeth should bear the brunt of all loads. This implies that the inner aspects of those cusps that will become the "centric supporting cusps" should contact their opposing cusps. The occlusal scheme of the overcasting of the implant should only have contact in centric. Therefore, the centric supporting cusp tip or line angle will be the only part of the centric supporting cusp in contact on this particular overcasting. The inner aspects of the centric supporting cusps on this overcasting are not necessary to be in contact. If they were, it would only provide a greater potential area for interference and

untoward force vectors being placed upon the blade vent. In excursive movements a rapid disclusion should occur. After the first millimeter of movement there should be no contact on the implant. This would imply that either a cuspid disarticulated occlusion or group function on the proximal abutment teeth should be utilized. The guiding cusps should be very small in relation to the centric supporting cusps on the implant. It is not necessary that the surface area of the occlusal table over the implant be of the same dimension as the other teeth in the prosthesis.

The buccal and lingual contours of the provisional splint should protect the investing structures and be so constructed that food is dissipated away from the very delicate dentino-gingival structures. There should be a continuity between the hard structure of the restoration and the soft tissue structures.

As far as possible, all pontic areas should be sanitary. This would preclude the use of ridge lapped pontics; for the most part they are only debris collectors and create an environment for microcosm which creates inflammation throughout the entire restored area. The interproximal area should be as wide as possible to create a maximum self cleansing area and one that the patient can manage with only usual oral physiotherapy techniques.

Cementation is an extremely important consideration in the provisionalization step. It is this writer's opinion that a removable overcasting should be placed over the implant and over that the provisional splint. Temporary cement should always be used in the area of the implant. This will allow the operator to evaluate his occlusal design. If the temporary cement continually breaks its seal, the therapist should be aware of a tortional problem and untoward forces being generated in a "flexion" like fashion towards the distal abutment, which in this case would be the implant. One must remember that there is no protective attachment apparatus about an implant; any force that cannot be easily dissipated by the surface area of the implant will cause pressure resorption of the surrounding bone and a potential epithelization of the wound with eventual exfoliation of the implant.

Following a waiting period of three to six months the area for restoration can be completed. The impression technique to be utilized in this area is of importance. Any technique that will luxate the implant upon its removal must be evaluated very carefully. Since there is often an undercut area between the base of the clinical crown of the implant and the tissue, an area of drag is created. This drag can put undue pressure on the implant and cause its extraction. Probably a hydrocolloid impression technique or individual copper tube impressions would be the most advantageous.

Not too much can be said about the material of the final restorative case. It is this writer's opinion that procelain fused to gold is not indicated as a restoration to be used with implants. It appears that the molecular structure of the porcelain to gold combination is such that it does not allow energy generated by the occlusion to be obsorbed as readily as softer mater-

ials. Secondly, there is an inability to accurately control occlusal design because of the multiple fusing processes. Acrylic and gold at this time is probably the most predictable and manageable restorative material.

The final restorative case should closely approximate the occlusal design of the provisional splint. The areas to be emphasized in this occlusal design is the ability of the splint to be disarticulated as rapidly as possible to obviate all potential of excursive interference, particularly in the area of the implant. This substantiates the fact that the proximal abutment teeth should be extremely healthy so that their incisal guidance can disarticulate the case as rapidly as possible. The only contact to the implant should occur in centric occlusion. Contact in this area appears to be adequate to create physiologic force vectors to stimulate metabolism of the cellular elements of the osseous structure. The quantitative area of the inner aspect of the occlusal surface of the implant should be minimal in order to reduce any potential adverse crown to root ratio. This implies that the guiding cusp's surface area be relatively small in relation to the centric supporting cusps. It must be remembered that the principal purpose of the implant is to act as a distal abutment for a fixed prosthesis to obviate the use of a free end removable denture; therefore, it is not necessary that the occlusal table of this particular tooth provide large surface area for masticatory functions. Clinical impression belies the fact that a large occlusal table is necessary to potentiate masticatory function.

It does not appear that implants require any unusual oral physiotherapy maintenance procedures. The area should be cleaned in the usual fashion. Dental plaque collecting about the margin of the restoration over the implant should be removed by normal oral physiotherapy techniques. It should be emphasized that disclosing wafers or any other visual means of identifying this plaque should be emphasized to the patient. The use of pipe cleaners, stimudents, and other home care aids may be utilized with safety about an implant provided adequate embrasure space has been created.

The permanent fixed prosthesis should be removed as little as possible to prevent tortion to the implant. The proximally prepared abutment teeth should either be telescoped and/or semi-permanently cemented. Care should be taken to remove all excess cement to prevent soft tissue inflammation. No exogenous irritants should be present about the implant or migration of epithelium in the area may be initiated with a resulting exfoliation.

The use of ultra high frequency cleaning devices should be discouraged in the area of the implant as crazing of the cement and breaking of the cement seal will often occur.

Provided the factors discussed in this paper are recognized by the clinician, and the patient is informed of the potential unpredictability of this particular therapeutic procedure, there is no reason why it should not be utilized and considered in the full therapeutic armamentarium of the dentist.

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The Role of Dentistry in the Treatment of Alcoholics

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SUMMARY

This report discusses the feasibility of the inclusion of clinical training in the dental curriculum to acquaint dental students and graduate dentists in a multi-disciplined approach to the problem of alcoholism.

A training grant was submitted to the National Institute of Mental Health to involve the Schools of Medicine, Dentistry, Law, Pharmacy, Social Work, and Nursing in joint training programs. A portion of the evaluation is presented in this report, which involved the rotation of a senior dental student through the medical clinical facilities available at the Baltimore Campus. The results suggest that there is a need to include dentistry in the rehabilitation of alcoholics; there are clinical facilities which could complement a didactic approach to education in this direction, and dentistry would assume an important role on the total health care team in treating alcoholics.

INTRODUCTION

Traditionally, the problem of alcoholism has been the concern of the medical, nursing, and legal professions as well as various federal, state, and private social agencies. It is the opinion of these investigators that the rehabilitation of alcoholics is the responsibility of all health professionals, regardless of the extent of contact with patients subject to this disease. This report concerns itself with dentistry.

The dentist must be aware of the problem of alcoholism and its relationship to his patients' health. The areas of involvement of dentistry in the rehabilitation of alcoholics appear to be ambiguous at this time, due to lack of familiarity with alcoholism as a disease entity in the dental curriculum.

Drug dependence as defined by the World Health Organization's Expert Committee on Drug Dependence is a "state, psychic and sometimes also physical, resulting from the interaction between a living organism and a drug, characterized by behavioral and other responses, that always include a compulsion to take the drug on a continuous or periodic basis in order to experience its psychic effects and sometimes to avoid the discomfort of its absence." Tolerance may or many not be present.[1]

In 1955, the WHO Expert Committee on Alcoholism classified ethanol, or alcohol as it will be referred to in the remainder of this paper, as a dependence producing drug.[2] The physical and psychological dependence produced by alcohol is commonly known as alcoholism. In recent years, the American Medical Association and the World Health Organization have come to regard alcoholism as a specific disease entity. Alcoholism is now regarded as a type of drug dependence of pathologic extent and pattern which ordinarily

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interferes seriously with the victim's health and his adapatation to his environment. More specifically, alcoholism is defined by the American Medical Association as an illness characterized by preoccupation with alcohol and loss of control over its consumption usually leading to intoxication if drinking is begun; by chronicity; by progression; and by tendency toward relapse. It is typically associated with physical disability and impaired emotional, occupational, and/or social adjustments as a direct consequence of persistent and excessive use of alcohol.[3]

The number of people who fall into the category of alcoholic is so extensive that alcoholism may be considered an epidemic disease.[4] While it is impossible to accurately state the statistical extent of alcoholism, it is estimated that 10% of the adult population of the U. S. are alcoholics.[5] Thus, there are roughly nine million alcholics in the U. S.[6] Within the city of Baltimore, population 905,759[7], the target area of this paper, the number of alcoholics has been conservatively estimated as 75,000.[8] It is known that alcoholics occupy at least 30% of the beds in each of two of Baltimore's major hospitals—University Hospital and The Johns Hopkins Hospital.[9]

OBJECTIVES

The objectives of this study are threefold. First, to establish the feasibility of a dental training program to familiarize dental students with the problem of alcoholism and the treatment of the alcoholic patient. Second, to initiate a dental survey within the greater Baltimore area to ascertain the specialized dental requirements of alcoholics. Third, to determine the need for dentists in alcoholic rehabilitation and in what areas of rehabilitation dentistry may become involved.

METHODOLOGY

To fulfill the objectives of this study, two procedures were followed: (1) observation was made of various areas for treatment of alcoholics, of the medical care received by or available to the alcoholics, and of the personnel available at the treatment sites and (2) dental examinations were performed on alcoholic patients in those areas.

University Hospital's Emergency Room, Tuerk House, an open clinic, and a hospital ward were the selected treatment facilities. These sites were recommended by Mr. James J. O'Donnell, Coordinator of Training-Alcoholism Programs of the University of Maryland. The inclusion of other sites was not possible at this time due to logistics and availability of personnel.

The emergency room of University Hospital is frequently the first treatment area for Baltimore's alcoholics. The majority of emergency room patients treated for an alcohol problem did not enter the emergency room voluntarily, but were brought there involuntarily either by the police or friends. Approximately ⅓ of all patients seen in the emergency room have an alcohol problem. Acute or chronic alcoholism may or may not be related to the patient's reason for seeking emergency room treatment. It appeared that those patients treated for alcohol problems were generally inebriated or suffering from delirium tremors. An alcoholism counselor is on duty periodically to help the alcoholic with non-medical emergency problems.

The Tuerk House is a quarter-way house associated with University Hospital. A quarter-way house is a treatment facility provided for the alcoholic who wishes to maintain a period of sobriety but is unable to do so on his own. The program of treatment is intermediate between a hospital detoxification ward and a half-way house. In the hospital ward the patient is more or less confined to a bed and receives little more than medical treatment. The distinction between a quarter-way and a half-way house is that a quarter-way house is designed to provide the patient with a controlled environment to facilitate maintenance of sobriety for a defined and limited period of time. On the other hand, the half-way house provides a less limited period of rehabilitation in a less strictly controlled environment. The male alcoholic admits himself, and arranges to reside at the Tuerk House for fourteen days. During this period, he is not allowed to consume alcohol, is required to attend group meetings, and may receive personal counseling. In addition, the Tuerk House resident may receive medical attention from a physician and a nurse who are present one morning a week. The physician makes any referrals necessary for the patient to receive further adequate medical treatment. The Tuerk House houses 20 men and generally operates at full capacity. During the year and a half period of operation, the staff claims a 33% success rate.

The Outpatient Department of University Hospital maintains an open clinic to which alcoholics may come for basic medical treatment and referral. The open clinic is staffed by a physician, a nurse, an alcoholism counselor, and a social worker. The patients are seen on a continuing basis, once a week and have the services of the staff at their disposal.

University Hospital is staffed with alcoholism counselors whose services are available to patients with drinking problems. An alcoholism counselor is a person who has received formal training in the management of alcoholics. The operations of counselors were observed. The function of the counselor is to acquaint the patient with the various treatment facilities available to alcoholics and to initiate alcoholic rehabilitation while the patient is in the hospital.

In addition to observation, dental examinations to determine the DMFT[10], were performed at the following locations: Tuerk House, the open clinic, and the third floor ward of the hospital. The examinations were conducted under field conditions, i.e., either in a hospital bed or a chair other than a dental chair. A tongue blade was used for retraction and a flashlight was used to provide adequate illumination. Neither explorer nor a mirror were used. The examination was limited to 28 teeth, since radiographs were not used. Thus, the difficulty that would confront the investigator in derermining accurate classification for any missing third molar teeth was eliminated. Each tooth was recorded as decayed, missing, or filled. The patient's age, sex, race, and approximate date of last dental examination and /or treatment were recorded, as was the patient's estimation of period of alcoholism.

RESULTS

A. *Evaluation of Areas for Training Dental Students*

The areas of observation were evaluated for their usefulness in a dental training program to familiarize students with alcoholism.

The alcoholic patients in the emergency room are often incoherent and physically debilitated. They are in need of immediate medical care, before any attention can be directed toward their dental problems, unless a traumatic injury of the oral structure is involved. The alcoholic emergency room patients are not concerned with their oral condition, and the staff experience has led them to believe that some of thr alcoholics if inebriated or if approaching delirium tremors may become violent or convulsive if they felt they were going to be submitted to dental trauma of any type. Based on the above information, the emergency room would not be suitable for inclusion in a dental training program.

The Tuerk House proved to be an ideal area for dental training in alcoholic treatment. The house offered 20 patients exhibiting various degrees of sobriety in a controlled setting for a period of two weeks. The patients were amenable to dental examination and offered a wide variety of dental pathology including traumatic injury to the oral and perioral structures. As a result of the number of patients always in the Tuerk House, it was possible not only to gain information about the dental problems associated with alcoholism, but also a limited understanding of the psychological makeup of the alcoholic.

The open clinic was found to be of use only as a resource for referral to a dental clinic.

The hospital ward demonstrated the medical treatment of alcoholism in a hospital setting. The alcoholics' medical needs were attended to while the patients' dental health needs were totally ignored. Like the open clinic, the hospital wards could be used as a resource for patient referral to a dental clinic.

B. *Evaluation of Dental Health Status of Alcoholics*

Dental examinations were completed for 57 subjects. The mean age for all subjects was 40.91 years. The racial ratio was almost 1 : 1 white to non-white patients. The mean age for the white patients was 42.5 years, and 39.4 years for the non-white patients.

The dental findings for both races, individually and combined were representative of National averages.[11-13] There are increasing DMFT Scores (Table 1) with advancing age. The missing tooth component is the most significant contributor to the DMFT Score with advancing age. There is a consistent decrease in the mean filled component scores. By virtue of the trends of the missing and filled tooth components, the decay component demonstrates a tendency to slightly decrease with advancing age.

Similar findings occur when the white male alcoholic are examined (Table 2). However, the trends are less obvious for the non-white alcoholics (Table 3). Statistical comparisons (Table 4) of the total mean DMFT Scores and its components were completed between white and white male alcoholics. The mean DMFT score of 19.92 (± 4.56) for white male alcoholics was significantly (95% level) greater than the score of 14.20 (± 2.98) for their non-white counterparts. In addition, the white males presented significantly higher scores for the missing and filled component than for the non-white males. However, the non-white males presented a significantly higher score for the decayed tooth component.

The over-all dental findings are consistent with data presented by other investigators.[14] The similarity

of the results are outstanding, particularly in view of the small sample population in this study.

DISCUSSION

One purpose of this study was to establish the feasibility of possible training areas for dental students. The sites selected for evaluation were all of the resources available for alcoholic treatment and rehabilitation associated with the University of Maryland Hospital. Based on eight weeks of observation, it is felt that the Tuerk House offers the most ideal environment for a dental training program. The availability of patients and the cooperation of the staff members provided an area conducive to learning about alcoholism, alcoholics, and the dental needs of alcoholics. The remaining areas of rehabilitation, mentioned previously, offered much less insight into the dental requirements of alcoholics and areas of involvement of dentistry in alcoholic rehabilitation. While each area did have something to be learned from it, it is felt that the Tuerk House was the most feasible of all sites observed for inclusion in a dental training program.

Based on the information presented in this report, it is felt that a definite need exists for the involvement of dentistry in alcoholic rehabilitation. The status of oral health of alcoholics was entirely overlooked in all phases of rehabilitation. In most of the treatment areas patients were not routinely referred to a dentist. If a patient specifically requested to be referred to a dentist, he usually encountered difficulty since the staff members at the various sites were not well informed about dental treatment facilities, their availability, or procedures necessary to secure treatment.

One author (G. K.) of this paper was approached directly by the patients on many occasions for the purpose of referral for dental care. Among the more illustrative referrals was that of a Tuerk House patient who had been the victim of a mugging and directly after the incident was taken to a city hospital. He was kept overnight and released At the Tuerk House the patient presented himself to this investigator with a swollen, painful face and multiple facial lacerations. In addition, paresthesia of the alla of the nose and upper lip was present. Referral was made to the Dental Department of University Hospital. After clinical and radiographic examination, the patient was admitted to the hospital as an oral surgery patient, for the open reduction of a multiple fracture of the zygoma. In another instance, a patient was seen at the Tuerk House complaining of a pain in his mouth. Examination revealed an abscess draining from a point on the gingiva and cervical lymphadenopathy. He was referred to University of Maryland Dental School Clinic for treatment. Many other referrals were made for complaints of toothache, poorly fitting dentures, abcesses, etc. The above cases clearly demonstrate the unmet dental health needs of alcoholic patients in the sites included. It is concluded that a dentist's services should be required in the comprehensive rehabilitation of alcoholics.

CONCLUSION

The following conclusions can be defined from this study:

1. there is a need for dentistry in the total rehabilitation of alcoholics;
2. there is a well established framework in which dental

students and dentists can be trained to treat the alcoholic patients;

3. there is a definite need for the inclusion of training and understanding the alcoholic in dental education, based on the significance of the prevalence of the disease entity under discussion;
4. there is a lack of treatment of dental emergencies, other than severe fractures resulting from trauma;
5. the dental health status of the alcoholics examined in this study is similar to that of other alcoholics in different geographic locations, as well as the general population.

RECOMMENDATIONS

It is the opinion of these authors that a well designed program should be established to allow the dental students to become familiar with the various modalities in treatment of alcoholics and the means to render efficient and proper dental services to this increasing segment of the population.

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TABLE 1: The Mean DMFT Scores (decayed, missing, filled teeth) and the mean decayed, missing and filled component scores of the DMFT Index for male alcoholics by age.

Age Intervals	*Frequency*	*Mean Decayed*	*Mean Missing*	*Mean Filled*	*Mean DMFT*
20–25	5	2.00	3.60	2.00	7.60
26–30	6	4.00	6.66	3.83	14.49
31–35	11	5.91	6.73	3.36	16.00
36–40	8	5.75	7.25	0.50	13.50
41–45	10	5.10	11.80	2.20	19.10
46–50	6	5.17	14.50	0.33	20.00
51–55	5	3.20	22.40	1.60	27.20
56–60	4	2.00	19.50	1.00	22.50
60 +	2	0.50	16.50	0.00	17.00
TOTAL	57	x = 4.42 s = 1.56	x = 10.84 s = 5.58	x = 1.92 s = 1.25	x = 17.19 s = 4.83

TABLE 2: The Mean DMFT Scores (decayed, missing, filled teeth) and the mean decayed, missing and filled component scores of the DMFT Index for white male alcoholics by age.

Age Intervals	*Frequency*	*Mean Decayed*	*Mean Missing*	*Mean Filled*	*Mean DMFT*
20–25	0	....	....	....	....
26–30	2	1.00	11.00	4.00	16.00
31–35	7	5.00	5.71	4.15	14.86
36–40	4	4.25	8.25	0.00	12.50
41–45	5	4.20	16.60	3.20	24.00
46–50	4	3.25	19.75	0.50	23.50
51–55	3	3.67	20.33	2.67	26.67
56–60	3	0.00	24.67	1.33	26.00
60 +	0	....	....	....	....
TOTAL......	28	x = 3.53 s = 1.59	x = 13.99 s = 6.72	x = 2.39 s = 1.59	x = 19.92 s = 4.56

TABLE 3: The Mean DMFT Scores (decayed, missing, filled teeth) and the mean Decayed, Missing and Filled component scores of the DMFT Index for non-white male alcoholics by age.

Age Intervals	*Frequency*	*Mean Decayed*	*Mean Missing*	*Mean Filled*	*Mean DMFT*
20–25	5	2.00	3.60	2.00	7.60
26–30	4	5.50	4.50	3.75	13.75
31–35	4	7.50	8.50	2.00	18.00
36–40	4	7.25	6.25	1.00	14.50
41–45	5	6.00	7.00	1.20	14.20
46–50	2	9.00	4.00	0.00	13.00
51–55	2	2.50	20.50	0.00	23.00
56–60	1	8.00	4.00	0.00	12.00
60 +	2	0.50	16.50	0.00	17.00
TOTAL	29	x = 5.27 s = 2.55	x = 7.44 s = 4.78	x = 1.48 s = 1.17	x = 14.20 s = 3.98

TABLE 4: Comparisons of mean DMFT Scores (decayed, missing, filled teeth) and mean Decayed, Missing, and Filled component scores of the mean DMFT Index for alcoholics by race.

Race	*Frequency*	*Mean Decay*	*Mean Missing*	*Mean Filled*	*Mean DMFT*
White	28	3.53 (±1.59)*	13.99 (±6.72)	2.39 (±1.59)	19.92 (±4.56)
Non-White	29	5.27 (±2.55)	7.44 (±4.78)	1.48 (±1.17)	14.20 (±2.98)
		p‡ = <0.01	p = <0.01	p = <0.01	p = <0.01

* Standard deviation
‡ "t" test of significance

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Two complete manuscripts with illustrations should be sent to the Editor, Journal, Baltimore College of Dental Surgery, University of Maryland School of Dentistry, Baltimore, Maryland, 21201. The articles which are submitted for publication are expected to follow the format suggested below. It is assumed that the papers are based on original data and that they have not been published or previously submitted for publication in other Journals.

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Each article should be sequentially arranged as follows:

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